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Electronics Australia

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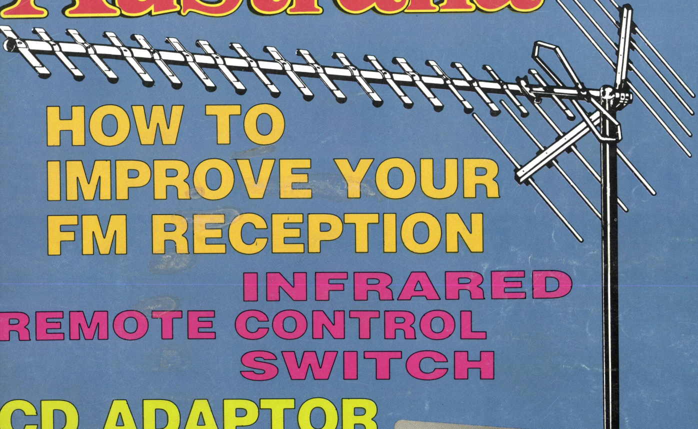

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CD ADAPTOR FOR CARS

UHF CONVERTER FOR CHANNEL 28

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THIS MONTH'S COVER

Fretting about Channel 0/28? Build this new UHF to VHF converter and come back to the world of SBS television. Details page 24.

Electronics Australia

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April 1986

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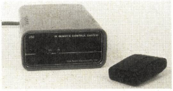
Infrared Remote Control Switch

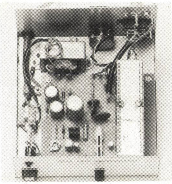


With this simple project, you can switch any mains appliance on and off from the comfort of your lounge chair. There's no need to get up . . . just press the button. Construction begins on page 40.

What's coming

Next month we intend to publish the details of our exciting new 60W per channel stereo amplifier. See page 45 for further details.

UHF to VHF Converter



This low-cost converter will allow you to receive UHF programs on your VHF-only TV set. The circuit goes together easily and does not require any alignment or adjustments. See page 24.

Apology

Due to a last minute hold-up, our final article on the Algernon robot will not run until next month.

EDITOR
Leo Simpson, B.Bus. (NSWIT)

ASSISTANT EDITOR
Greg Swain, B.Sc. (Hons. Sydney)

EDITORIAL CONSULTANT
Neville Williams,
F.I.R.E.E (Aust.) (VK2XV)

TECHNICAL STAFF
John Clarke, B.E. (Elect. NSWIT)
Colin Dawson
Robert Flynn
Louise Upton, B.A. (Hons. Sydney)

ART DIRECTOR
Brian Jones

ART PRODUCTION
Alana Horak

SECRETARIAL
Carmel Triulcio

ADVERTISING PRODUCTION
Danny Hooper

ADVERTISING MANAGER
Selwyn Sayers

PUBLISHER
Michael Hannan

HEAD OFFICE
140 Joynton Avenue (PO Box 227),
Waterloo, NSW 2017. Phone: (02) 663 9999.
Telex: AA74488. Facsimile: 662 1007.
Representative: Norman Palmer.

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ADVERTISING OFFICES
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Waymouth Street, Adelaide 5000. Phone:
(08) 212 1212.
Representative: Dane Hanson.

Brisbane: 26 Chermside Street, Newstead,
Qld 4006. Phone: (07) 854 1119.
Representative: Bernie Summers.

Perth: Tony Allen and Associates, 7 Fore
Street, Perth, WA 6000. Phone: (09)
748 9833.
Representative: Jim Wells.

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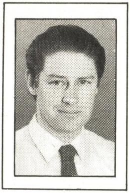


Editorial Viewpoint

by Leo Simpson

Clearing TV from the FM band won't be easy

If you live on the New South Wales South Coast, you are certain to be aware of recent moves to shift TV stations from the 88-108MHz FM band. The Illawarra television operator, WIN-4, has been informed by the Minister for Communications, Mr Duffy, that it is to move to the UHF band within the next three years. At the same time, extra commercial services will be provided to the Illawarra service area so that these regiona viewers will have TV services comparable with Sydney viewers.

While this may seem like a drastic instruction to WIN-4, it is part of an entirely reasonable and logical plan by the Department of Communication to accomplish several long-term results: (1) move all TV stations from the FM band, ie, channels 3, 4 and 5. (2) Give all regional TV areas three commercial TV services, the same as the major metropolitan areas and (3) establish all new TV services on the UHF bands. At the same time, the plan is to move channel 5A which interferes with communications services.

In the first of these moves, clearing the FM band, the Department of Communications is merely correcting a silly decision made by the Government in the late fifties in answer to strident demands by the then Australian television manufacturers for more TV channels. It is worth remembering that this is how Australia came to be the only country in the world which had TV stations allocated in the FM band. Now, the Department has the unenviable task of clearing the 88 to 108MHz band so that more FM stations can be licensed.

Not unexpectedly, WIN-4 is fighting the planned move and has come up with an alternative proposal whereby it and the extra TV services could be accommodated on channels 6, 8 and 11. The Department, for its part, has claimed that this would interfere with existing reception of Sydney channels 7, 9 and 10 by viewers in the Illawarra region. This may not be a problem with modern receivers but it is certainly a point to be considered.

But there is another more severe problem. Based on the existing poor reception of SBS transmissions in much of the outlying Illawarra regions, it seems likely that many viewers who now have quite satisfactory or perhaps marginal reception of WIN-4, will have little or no commercial TV reception when the services are moved wholly to the UHF band. This applies both to people who could legitimately be regarded as being within the WIN-4 service area and to those who are well outside it, down on the far NSW south coast.

As far as the Department is concerned, these problems are not insurmountable. First of all, the DOC points out that the existing SBS service in this region is intended to cover the immediate Wollongong area only and not the entire Illawarra region. It is planned to extend SBS services to regional areas at a later date. So judgments on signal coverage, based on the existing Wollongong SBS service, are invalid.

Letters to the editor

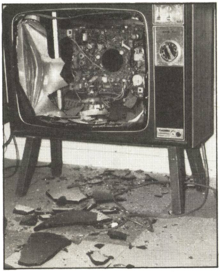
An exploding picture tube

I have enclosed a photograph of a black and white picture tube which recently exploded. The set is a 23-inch model from AWA Thorn. It had been in working order but had not been used for many months, being stored in a vacant shop at the time.

There had been no-one in the shop where the set was stored, the plug position speaks for itself, and there were no known flaws or marks on the tube. For some unknown reason, it exploded with a loud bang, giving everyone in adjacent shops a heck of a fright.

It is rather scary to know that this can happen to a TV picture tube, especially as it is even more likely when the serviceman has his head in the works.

The back of the tube was pushed backwards and broke some valves. However, it is hard to understand why the front safety glass, which is about a ½-inch thick, should also have exploded into pieces in a forward direction.



A.R. Holmes,
Theodore, Qld.

Parts for Budget 2-way Loudspeakers

With reference to the Budget 2-way Loudspeakers published in the November 1985 edition, I have been told by a Magnavox agent in Brisbane that the part number for the tweeter used in the project is incorrect. The correct speaker number is 3UC, not 3AC. He states that Magnavox don't manufacture a speaker with the number 3AC.

Please advise which number is the correct one.

T. Charteris,
Nerang, Qld.

- As noted in our March Editorial, Magnavox has now gone out of business and so the question is largely academic. The good news is that we have located a source of alternative drivers and hope to publish the details soon.

Marklin locos on AC

In reply to A.H. Morley, WA, in EA, January 1986, I would like to make the following points.

Marklin have been making HO gauge electric trains in the 4-20VAC format for over 50 years, using initially a third rail and now an almost invisible series of stud contacts protruding through the sleepers. These, in conjunction with a pick-up shoe on the loco, provide the supply, with both rails acting as common ground.

This system avoids polarity changes in reversing loops — figure-eights, etc — and makes it so easy to set up and operate even complex layouts. Keeping in mind that model trains were originally made for kids, ease of operation was paramount. These days, the big kids (fathers) have taken over and the scene is changing.

Marklin locos are renowned for longevity and performance — tests prove superior power and traction over all the other makes. I believe it may be the field coils that give the extra power to the motor which, being universal, runs on AC, DC or pulse power.

If A.M.'s Marklin behaves as he describes, then a slight adjustment to the solenoid arm will cure his problem. Marklin has also introduced electronic reversing which eliminates the need for this adjustment and this should please A.M. Their new locos are state of the art.

What is lacking are circuits to control AC — simple inexpensive circuits. The Railmaster does operate Marklin but it's too expensive and bulky. Perhaps you could publish a circuit for Marklin fans.

A. Bognar,
Marklin Sydney Modeller's Club,
Sydney, NSW.

In the primary service area of WIN-4, the planned UHF coverage of the new commercial services will be at least as good as at present. In fact, it is an obligation on WIN-4, as a condition of their licence, to maintain equivalent service to their viewers, when the changeover to UHF occurs.

People who are well outside the effective service area of WIN-4, who nevertheless depend on it for their only entertainment, are in a different situation. Here the Department has a policy of "self help" whereby remote communities can apply to the DOC for technical and financial assistance in the setting up of UHF translators.

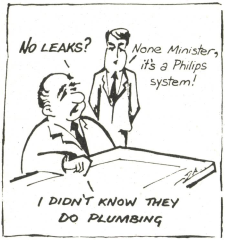
The upshot may mean that these people have to spend more money to regain the missing service but their resulting reception is likely to be better than at present — some of these remote areas have very weak reception that city viewers would not bother to watch.

One final problem remains with viewers in Sydney who enjoy fringe reception of WIN-4. They might not have this benefit with the changeover to UHF but when you think about it, that is really just too bad. They already have a good TV service anyway and the result of clearing the FM band will eventually mean that there will be a lot more FM stations, which will be good for everyone. So everybody gains in the long run (except if you are a shareholder in WIN-4).

Eventually, all regional television stations occupying the FM band will have to go through the changeover process so the Department has a difficult job with the Illawarra region. It will be something of a test case and if it does not go according to plan Australia may never have a comprehensive FM service and regional TV viewers will wait many more years for improved services. Let us hope that the DOC has done its homework very thoroughly.

News Highlights

Philips to supply electronic systems to Parliament house


No LEAKS?
None Minister, it's a Philips system!
I DIDN'T KNOW THEY DO PLUMBING

There will be no leaks in the new Parliament House in Canberra — at least not of the electronic kind.

Currently under construction, the new building will have one of the world's most extensive in-house information and communications systems. It will be capable of handling 100 TV channels with stereo sound, as well as 100 FM stereo radio channels.

The main task of the monitoring system is to link off-air broadcasts and the proceedings of both chambers to Hansard, the press gallery, the Parliamentary Library, the members' rooms and public areas. This will require 80km of coaxial cable with up to 1700 outlets.

A smaller quantity of cable will also be required for the in-house information network. This will provide computer communications, electronic mail and general computer services.

Contracts for this cabling and the associated equipment, worth nearly $1 million, has been won by Philips Australia.

Navigational system for cars

Computer-controlled navigation systems for cars are currently under development in several countries. One such system is based on the Philips compact disc which stores an electronic map in digital form.

Already, a prototype system, called CARIN for Compact Disc-based Car Information and Navigational systems, has been tested in the Netherlands. It combines a compact disc drive, a computer and a car radio. Directory information for an entire city can easily be accommodated on a single disc, including street names and traffic flow directions.

When a CARIN disc is loaded into the system, the driver has only to enter in the departure time, the destination points and any special route that may be preferred. The route best meeting these requirements is then planned and stored in the memory.

During the journey, CARIN monitors progress and provides navigational information to the driver via a speech synthesiser. If the driver makes a mistake, the computer will automatically find the best diversion to get back on the correct route.

Basically, the computer calculates the car's actual position by 'dead reckoning' using inputs from an electronic compass for direction, and an odometer for distance. By means of regular map correlation, the computer checks the accuracy of the position-fixing and makes corrections as and when necessary.

According to Philips, the system has been carefully designed to ensure safety and simplicity of operation. For example, the entry and display modes are only enabled while the car is stationary, or are for use by a passenger only.

In addition to supplying navigational information, CARIN can also supply travel information, such as hotels, restaurants and places of interest at any stage of the journey.

Pocket-size colour TV

The pocket colour TV war is about to ot up. Matsushita Electric Industrial Co., Japan, has developed a 7.5 cm (3-nch) diagonal liquid crystal display LCD) panel which, the company says, ffers pictures "as crisp as those found sing conventional cathode ray tubes".

Initially, the new LCD panel will be sed in a pocket-size colour TV set to e sold in Japan and North America. Displayed at the Winter Consumer Electronics Show in Las Vegas last anuary, the new TV set is just 22mm hick and will sell in the US for $299.

The high-clarity picture is made possi-le by 89,280 individual picture ele-nents (240 x 372 pixels) and a thin film ransistor matrix system which enables ubtle variations in hue and colour in-ensity. Technological innovations claimed for the LCD include the use of multi-gap colour filters, triangle colour formation of red, green and blue pixels, and a black matrix which dramatically improves contrast and overall picture quality.

There are no plans at present to market the set in Australia.

World's smallest colour video camera system

Toshiba Corporation has developed a colour video camera system with the world's smallest camera head utilising a CCD (charge coupled device) sensor. The new system is said to provide colour pictures superior to those obtained from conventional half-inch video cameras.

Unlike most other video camera systems, the new design separates the camera head from the control unit so that it can be used for a variety of special uses. It can be easily connected to a standard TV monitor on a television screen or to a video cassette recorder.

In devising the small camera head the company developed a new packaging technology which can embed a 200,000-picture dot CCD sensor into less than one third the usual space.

According to Toshiba, the new camera has a wide range of field applications including TV, manufacturing, robotics and medicine.

New Australian shortwave stations

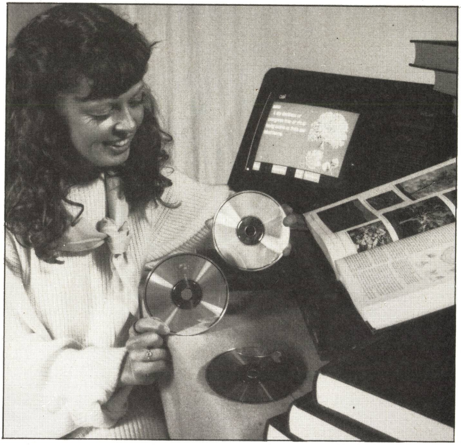
The first of three new transmitting stations for the ABC shortwave radio service has commenced operations at Alice Springs. The other two stations, at Tennant Creek and Katherine, are scheduled to begin transmissions later this year.

According to the Department of Communications, the three 50kW transmitters are designed to provide blanket coverage of the Northern Territory. Programs will originate in Darwin and Alice Springs and will include much of the material broadcast on ABC medium-wave stations serving Darwin, Alice Springs, Nhulunbuy, Jabiru, Katherine and Tennant Creek.

The Alice Springs station broadcasts on 4.835MHz during the day and 2.310MHz at night and early morning. Its call sign is V18A. Tennant Creek (V18T) will broadcast on 4.910MHz and 2.325MHz, while Katherine (V18K) will use 5.025MHz and 2.485MHz.

The service is designed to complement the new satellite broadcasting service for which fixed equipment is required.

News Highlights



Discopaedia Britannica

Developed in the UK, this "elec tonic book" system could easily conta the complete text of the Encyclopaed Britannica on just one compact disc.

The news system is based on Phili CD ROM technology and can store u to 600 megabytes of information in a combination of text, pictures, graphic sound or software. It uses a compa disc player linked to a personal co puter and can provide colour illustr tions, animated sequences, and even a dible responses to give the correct pr nunciation of foreign or difficult words

For example, a conventional dictio ary contains around 80,000 entries an consists of 11 megabytes of text, whic means that 50 such dictionaries could b placed on a single disc. The full Oxfor English Dictionary would occupy ju over a third of the disc.

In one research project carried out a the Philips Research Laboratories i Surrey, some 15% of the entries in a English language dictionary were give an associated colour picture and nearl all of them had their pronunciation pro vided as an audible output. Selected en tries also had links to their antonyms synonyms and semantically relate words.

Signwriters go computerised

A computerised system has been developed which has the potential to boost the productivity of Australia's 3000 signwriters.

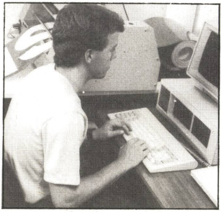
The Computerised Signmaking System removes the tedium and repetition of lettering design and screen printing, leaving the signwriter time to chase up clients, new business and design work.

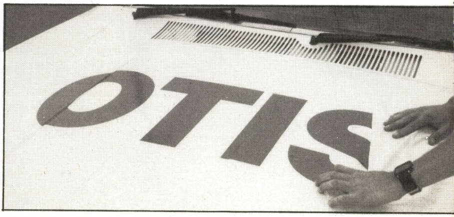
Using a Philips P3100 personal computer, digitising tablet and plotter the system can cut and produce signs from simple lettering to complex designs, from adhesive backed vinyl. The plotter can also draw lettering and graphics according to the users' specific directions.

The system is easy to operate. Basically, the computer and digitiser are used to design lettering and graphics while the plotter uses a tungsten-tipped cutter to produce lettering or designs from vinyl or paper.

The plotter can also be used to pro duce mirror images and lettering and graphics can also be drawn on the finest screen printing stencils.

The Philips P3100 Personal Computer with plotter and software costs $18,00 while the optional digitiser is priced at $5,565. The package is distributed in Australia by Wilenco Pty Ltd, 31 Victoria Ave., Castle Hill, NSW.





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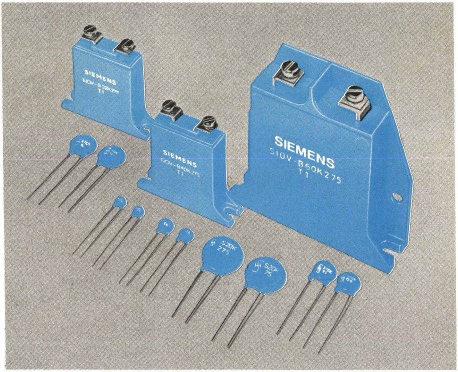

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TV or FM antenna: which is best?

Getting the best from your FM tuner

Despite all the money that many of us spend on hifi equipment, the truth is that most of our music comes from one source, FM radio broadcasts. Unfortunately though, most tuners don't give their full sound potential. Here's how to get it.

by LEO SIMPSON

There are good and sensible reasons why we rely on FM broadcasts as our main source of music. The FM stations have a far greater record selection than most of us can ever hope to own and it is much easier to tune to a station than to select your own music to suit your mood. If the music played at the moment does not suit your mood, it is easy to change stations.

With this in mind, it is perhaps surprising that more money is not spent on the tuner in most hifi systems. Typically, the FM tuner is one of the cheaper components in the installations. Even so, most tuners in the $200 to $300 bracket are capable of very good FM reception, even though their AM reception is woeful.

Unfortunately, most FM tuners do not go anywhere close to achieving the fine performance of which they are capable. They don't have a chance. Most simply operate from a bit of wire which is supplied at purchase and dignified by the description "simple dipole" or "folded dipole".

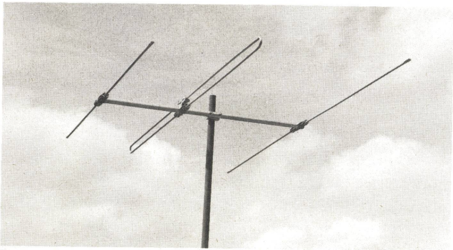
The owner's manual supplied with most tuners describes how this rudimentary antenna can be tacked up over a window or on a convenient wall. Bu most tuners don't even get the benefi of this. The wire is usually just dangled out the back of the unit in an untidy mess.

Actually, it would be better if this rudimentary wire antenna was not supplied at all. It does work but it is not much better than the proverbial "piece of wet string".

Much better results are possible from a correctly installed antenna. In fact, it is more important to have a good FM antenna than it is to have those expensive cables that so many people are now using to connect their loudspeakers. The audible benefits are much greater.

As an indication of this, the very finest FM tuners available today are capable of achieving a signal-to-noise ratio of 85dB or more, in stereo. That is better than the best FM broadcast transmitters are capable of and is only slightly worse than typical compact disc players. But to extract the best sound quality from the broadcast, these tuners need a good quality signal. If they are fed with that "bit of wire" their performance is likely to be no better than a $25 clock radio from your local supermarket.

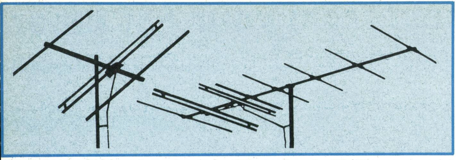
If you are serious about getting the best from your FM tuner, you must take the trouble to make sure it is fed with a good signal. After all, if you buy a new colour TV set, you don't expect to get a good picture with a length of cable hanging out the back. It's the same thing.



For many listeners, this three-element Yagi antenna from Dick Smith Electronics will be the best and simplest installation for good FM reception.

FM antennas

There are two ways of obtaining a good signal for your FM tuner. The first and best is to install an antenna specially designed for FM signals. This will look very similar to a standard TV antenna but it will usually be about two-thirds the size. The signal from this antenna should be fed down to a wall



Hills Industries Ltd have two antennas for FM reception, the Y3 FM, a conventional three-element Yagi and the 453 FM, a much higher gain eight-element Yagi for fringe-area reception.

socket via good quality coax cable which stops interfering signals from being picked up by the cable itself.

There are a variety of antennas suitable for FM reception. A typical example is the Hills model Y3 FM shown above. This is a three element Yagi consisting of a folded dipole, one director and one reflector (behind the dipole). This will be adequate for the majority of installations which are within about 25km or so from the main transmitters, provided you have a reasonable "line of sight".

In a similar vein, any of the television antennas which have been made to receive both channels 3 and 4 will be suitable for metropolitan FM reception. An example of this is the Hills model 15A34 which is cut to suit channels 3, 4 and 5A.

If you live further away from the transmitter, you will need a higher gain antenna such as the Hills model 453 FM This is a much larger antenna with two folded dipoles, one reflector and five directors. It will give good FM reception at distances of 100km or more from metropolitan stations.

What about your TV antenna?

Another possible way of obtaining a good FM signal is to use your existing TV antenna. Unless it is one of the category already mentioned above, it may or may not be good enough. The trouble with using the typical all-station Yagi TV antenna, which will have been cut to receive channels 0, 2, 7, 9 and 10, is that any FM signal received will be more by accident than by design.

Any signals they pick up will probably have "brute forced" their way into the antenna. The weaker stations probably won't be received at all.

The problem with these older Yagi-type designs, which have one long and one short dipole, is that they have a big "hole" in their pickup response between channels 2 and 7, ie, smack-bang where the FM stations are.

This means that not only will the antenna have very poor FM performance, any FM signals picked may also be subject to "multipath distortion" because the antenna's directional characteristics are less than ideal.

Log periodic antennas

Log periodic antennas are a different kettle of fish altogether. If you live in a metropolitan area and have installed a new TV antenna in the last 10 years or so, it is more than likely that it is a log periodic type. Examples are the Hills EFC series (EFC1 to EFC4) and Hills Telray series (TL1, TL2, TL3 and TL4). The Hills EFC4 is shown below.

Because these are designed to have a flat response over all television channels from 0 to 11, they automatically give good coverage of the FM band. The same can be said for log periodic antennas by other manufacturers and for the new combined VHF/UHF arrays which use a high gain Yagi for the UHF bands and a log periodic section for the VHF bands. (See the article entitled "What to do about channel 0/28" in the December 1985 issue of EA.)

If you are not sure whether your antenna is of the log periodic type, there are a couple of visual clues. It may have a double-boom construction in the case of the Hills EFC range for example, or each of the elements will be connected to its neighbour by a series of crossed-over connections. This commonly has six or more elements, with the shortest at the front and then with each successive element progressively getting longer. They look rather like a flying wedge.

Don't rob the TV set

There is one drawback to using your antenna as a source of FM signals and this can arise as follows. The standard way of connecting the one antenna to both your TV and FM tuner is to feed the signal to a splitter and thence to separate wall sockets. Or you might use one of the TV/FM wall plates which have splitter components wired on to the rear of the two sockets.

These do work but they introduce a significant loss in the signal fed to your TV set. If you live in a strong signal area this will not matter but if your reception is marginal, the insertion loss of the splitter can make the difference between an acceptable noise-free television picture and one that is plagued by snow.

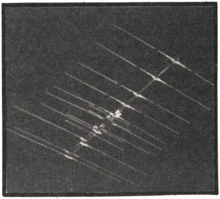
One way to ensure that this does not arise is to use the Hills TV/FM wall plate. Instead of incorporating a splitter with its attendant signal loss for both TV and FM signals, the Hills version has a directional coupler which causes negligible insertion loss to the TV signal although there is some reduction in the FM signal available.

Another way around the problem is to first couple the signal from the antenna to a splitter/amplifier such as one of the models made by Electrocraft. This combined unit allows for the signal loss and provides separate isolated 75Ω outputs for the TV and FM signals.

How much signal is enough?

This is a good question which is not asked often enough by FM listeners. In order to be able to achieve the "ultimate signal-to-noise ratio" (this is a tuner specification, not a fancy turn of phrase), the large majority of tuners need a signal of at least one millivolt. The quieting curves of Fig.1 clearly show this. They apply to the new Playmaster AM/FM tuner which is currently being described in this issue.

Notice how the signal-to-noise ratio increases as the antenna signal increases, until, at a value of two millivolts, the signal-to-noise ratio flattens



This is the Hills EFC4, a large log periodic designed for excellent colour TV reception but which also covers the FM band. Most log periodics do.

out to its ultimate value of 70dB in stereo mode. In mono mode, the ultimate signal to noise ratio is better, at 75dB, for an input signal of one millivolt.

Clearly then, if the tuner in question receives much less than one millivolt of RF signal for all the wanted stations, its performance will be less than its full potential. And if the input signal is less than 100 microvolts, the reception will be obviously noisy in the stereo mode.

How can you be sure that your tuner is receiving a good signal? One indication is to look at the signal strength meters on your tuner. Ideally, they should be indicating a full scale signal.

Unfortunately though, the signal strength meters on most tuners are pretty useless, and may consist of only one or two LEDs. About all they tell you is that you have a signal but they don't give any clue as to whether it is sufficient. Even where the tuner has a conventional meter it will often indicate full scale for quite weak signals.

Ideally, the signal meter should indicate the signal level which the tuner needs to give its "ultimate signal to noise ratio".

So even if your tuner's signal strength meters are indicating the maximum, it is quite possible that you still aren't getting the strength of signal needed for best performance. You are still in the dark.

That leaves only your ears as a guide but they can give you a reasonable indication. What you need to do is to compare the background noise on programs when the tuner is in mono and stereo modes.

Tune to your favourite station and listen carefully for background hiss during the quiet times, when the announcer stops talking or when the music is soft. Get a good idea of the level of hiss and switch between mono and stereo (using the mono switch on your tuner). If your tuner is getting a good signal there will be very little difference in the hiss in the stereo and mono modes.

On the other hand, if you notice a big increase in background hiss when the tuner is switched to stereo, you could benefit by having a stronger signal from your antenna.

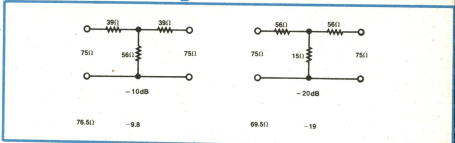
The reasoning behind this listening test is that if your tuner is receiving a strong signal, the noise level produced by the internal circuitry is likely to be less than that due to the transmitter and studio equipment. If your tuner is one of the better performers, its noise level in the stereo mode is still likely to be less than that produced by the station; ie, around 65dB or so.

Plainly, if this test indicates no difference in residual noise between mono and stereo signals, there is little point in having a stronger signal.

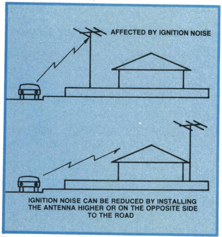
Even if you do receive a strong signal there may be a good reason to have a separate FM antenna installed. It is quite possible that even though your TV reception is quite satisfactory, its resultant FM reception could be plagued by "multipath" distortion. You may also find that for optimum FM reception, the antenna needs to be pointed in a different direction to that presently dictated for TV reception.

Antenna cable

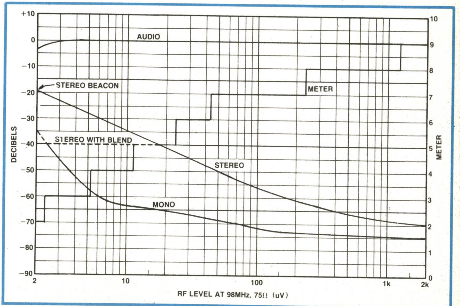
Whether or not you decide to have a separate FM antenna installed, the cable bringing the signal down from the antenna should be the coaxial type. This is desirable whether you want a clean television picture or interference-free FM reception. Do not use ribbon cable. It may have a small advantage in having less signal loss than for coax cable but this is rarely significant for the fairly short cable runs of most installations.



If your FM antenna gives too much signal, these attenuating networks can be inserted in series with the antenna cable to give 10dB or 20dB reduction.


AFFECTED BY IGNITION NOISE
IGNITION NOISE CAN BE REDUCED BY INSTALLING THE ANTENNA HIGHER OR ON THE OPPOSITE SIDE TO THE ROAD

To reduce ignition interference from cars, install your antenna as far away from the road as possible.



These quieting curves show how an FM tuner becomes progressively quieter with more signal. For noise-free stereo you want 200μV or more.

Offsetting the fact that it is cheaper nd has a little less signal loss, ribbon ble can cause problems due to a sigal pickup in the cable itself, causing e equivalent of TV ghosting: multiath distortion.

Before you decide to use the signal om your TV antenna, you should disnnect it from your TV, connect it to ur FM tuner, and carry out the listeng test described above.

nstallation

Having decided that you will have a parate FM antenna installed, a few otes are appropriate. In deciding here the antenna is to be installed, be ware that ignition noise from cars can e a problem, especially when listening o some of the weaker stations. To inimise this problem, keep the anenna as far away from the road as ossible.

In other words, if a lot of traffic asses by the front of your dwelling, intall the antenna at the rear, so that our home shields the antenna from the nterference.

You still need to be sure that the anenna has a reasonable line of sight to he main transmitters of interest. It is lso a good idea to mount the antenna s high as possible and well clear of surounding metal-work such as guttering nd metal roofs.

This is because any nearby metal tructure can reduce the performance of n antenna, particularly its directional haracteristics.

It is permissible to mount the FM anenna on the same mast as your TV anenna but keep the two as far apart as ossible, say a metre at least. Ideally hough, the vertical distance should be a minimum of two metres or more otherwise the performance of the TV antenna is likely to be prejudiced and ghosts may become a problem.

A final point which should be mentioned is that of signal overload. It is often ironic that people closest to the FM transmitter have the worst reception. This is not because of insufficient signal but too much, compounded by strong signal reflections which give rise to severe multipath distortion.

The way out of this problem is again to dispense with the simple dipole and install a standard three-element FM antenna. This will reduce the signal reflection problem but you then have the possibility of two much signal which will overload the tuner. This calls for an attenuator. Two such attenuators are shown in Fig. 2, for 10dB and 20dB signal reduction. ⓔ

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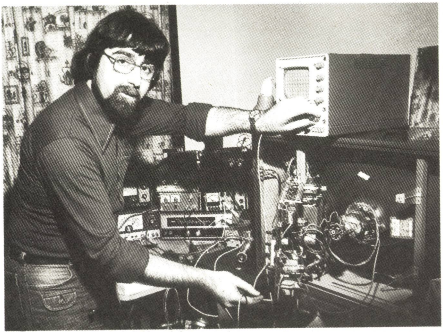

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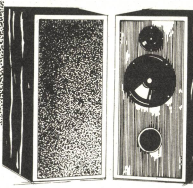

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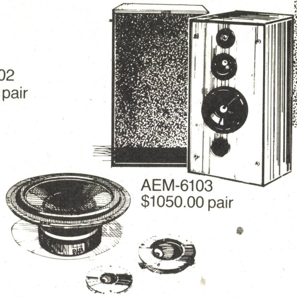

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These two hot selling high performance kit speakers are now being demonstrated at the locations mentioned beneath. Hear for yourself how these speakers outperform well known fully imported speakers costing 2-3 times more.

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RADIO PARTS, 562 Spencer Street, West Melbourne.
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STEVE BENNETT HI-FI, 105 Shannon Avenue, Geelong West.
BELAND ELECTRONICS, 294 Charman Rd., Cheltenham.
TAS: WILLS HI-FI, 11 The Quadrant, Launceston.
QUANTUM SOUND CENTRE, 194 Liverpool Street, Hobart.
HI-FI HOUSE, 32 Rooke St., Devonport.
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HI-FI HOUSE, Cnr. Crown & Corrimal Streets, Wollongong.
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JAYCAR, 117 York Street, Sydney.
JAYCAR, 121 Forest Road, Hurstville.
NEWCASTLE HI-FI, 642 Hunter Street, Newcastle West.
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For more information about speaker kits and reprints of the 2 above mentioned speaker projects, please contact Sole Australian Distributor:

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Onkyo DX-150 compact disc player

After a long absence from the Australian market, Onkyo has made a welcome return with a range of products that should live up to the high standard established by this brand more than 10 years ago. We have just tested Onkyo's DX-150 Compact Disc Player which provides all the programming and control features you could want.

The DX-150 Compact Disc Player is a largish machine measuring 435 x 92 x 350mm. It has a well-designed front panel with sensibly sized pushbutton control switches. The overall finish is matt charcoal with the lid of the case being a very fine crinkle finish (like Marviplate) black and the front panel being black anodised aluminium.

As with almost all current compact disc players, the Onkyo is a front-loading machine, with a disc drawer which slides out from the front panel to accept the disc. This is operated by the Open/Close switch located to the right of the disc drawer. It has a slightly obtrusive mechanical whine whenever the drawer is opening or closing, but of course the mechanism is quiet when playing a disc.

One good feature of the DX-150 is that the drawer will withdraw if pushed shut. This prevents the drive mechanism from damage should the drawer be forced closed — an abusive practice but one which sometimes happens.

The display indicators provide a very clear indication of player operation. The large (8mm) seven segment display is easily readable and the function indicators concisely show the operating status of the player.

All control switches for the DX-150, apart from the power and open/close buttons, are located to the right of the display window. They are well-labelled and easy to use.

Operation

Once the DX-150 CD player is loaded with a disc, the total number of tracks available is indicated by the display. At this stage, the memory can be programmed to play selected tracks or alternatively by pressing the Play/Pause switch, play will begin from track one. A small green indicator shows that play is in progress.

During play, the next or previous track can be selected using the Up and Down switches respectively. The player rapidly accesses the beginning of the selected track and begins play. In addition there are the Fast Forward and Fast Reverse switches for cueing and reviewing portions of a track. Pressing Play/Pause while play is in progress stops play but leaves the deck ready to resume when the button is again pressed. While paused, the play indicator flashes.

The display can be switched to show either the track number or the play time, by depressing the Display switch.

Programming

Programming involves the use of the Repeat/Memory, Memory, Clear and Up and Down switches. When the Repeat/Memory switch is pressed, the orange Memory indicator lights to indicate this mode. Pressing the Up or Down switch selects the tracks required, while the Memory switch programs this in memory. The Clear switch cancels the entry.

The contents of the memory can be reviewed using the Memory switch. The left hand side of the display shows the track number, while the right hand side shows the memory number.

Apart from the above programming features, the Repeat/Memory switch allows selection of three separate repeat functions. These are, repeat of one track, repeat all of the programmed tracks or repeat from A to B. Selection of the required repeat sequence is provided by pressing the Repeat/Memory switch.

This switch operates in a cyclic fashion so that normally neither the

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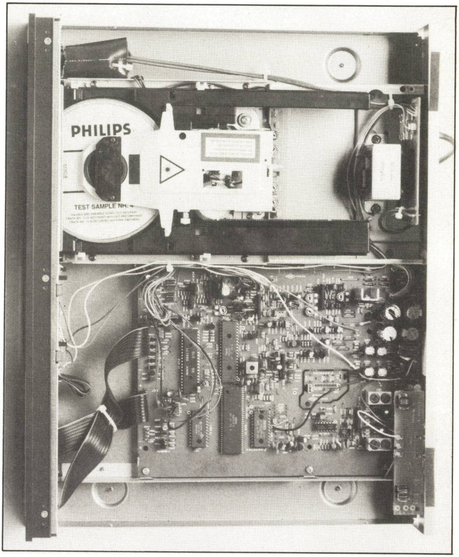

Memory nor the repeat selections will be selected. The first press selects the Memory, the second press selects the Repeat ONE, a third press selects the Repeat ALL and a final press selects the Repeat A-B. A further press deselects any of the choices. Beneath each repeat legend is a green indicator which lights to show the Repeat selection.

The A-B repeat feature can be used to replay a particular portion of the disc or, alternatively, used to play a disc whilst skipping over a particular section or track on the disc.

Internally, the Onkyo has a spacious chassis, with a single large printed circuit board on one side and the CD mechanism on the other. The steel construction of the chassis and drive mechanism is strong and the spacious layout means that servicing access is good.

Performance

Claimed performance figures of the Onkyo DX-150 are a frequency response of 10Hz to 20kHz ±2dB, a 96dB signal-to-noise ratio, .005% distortion at 1kHz and channel separation of 87dB at 1kHz.

The Onkyo DX-150 was tested using the Technics SH-CD001 test disc and a Sound Technology distortion measuring unit.

The first test checked the frequency response from 20Hz to 20kHz. The results for this were 0.5dB down at 10kHz, falling to −1dB at 15kHz and −2dB at 20kHz. This response is certainly within specification although we would have preferred a little less rolloff at the top end.

Distortion measurements resulted in readings of .01% at 20Hz, .03% at

1kHz, rising to .04% at 10kHz and 4% t 20kHz. While these look quite high, he true readings are much lower and re masked to an extent by artefacts of he 44.1kHz sampling process. Better iltering would remove these artefacts ut the sound quality would not necesarily be improved.

Signal-to-noise ratio was 90dB with espect to full output although this improves to 96dB as claimed, when hum is emoved from the measurement.

Linearity is a measure of the output rom the compact disc player against accurate 10dB decrements in signal level. For the DX-150, there was zero error at the −60dB level, +0.5dB at −70dB and +2.5dB at the −80dB level. Again, the actual results are somewhat better than the measurements, because the residual sampling artefacts mask the low level signals.

Separation between channels was good and measured −84dB at 100Hz, −83dB at 1kHz, −72dB at 10kHz and −70dB at 20kHz. This is reasonably close to the claimed specification of −87dB at 1kHz.

Tracking performance was checked using the Philips 4A test disc. While the Onkyo DX-150 could track all of the interruptions in the information layer from 400 to 900μm, the black dot caused mistracking at a size of 800μm. It tracked the simulated fingerprint successfully.

On our badly scratched disc, the DX-150 played most tracks except for some heavily scratched areas. Although we have tested machines that successfully track this disc completely, the Onkyo performed well.

The DX-150 is also quite immune to normal vibration and the occasional bump to the cabinet.

It is also a very pleasant machine to listen to, even though we may not have been able to fully confirm the performance specs.

To summarise, the Onkyo DX-150 has quality construction and a high standard of finish. It is easy to use and should reinforce the reputation of Onkyo as a quality brandname.

Recommended retail price for the Onkyo DX-150 is $649. It is available from selected hifi stores. For further information regarding Onkyo products, contact Regent Audio, PO Box 42, Pymble 2073, NSW. Telephone (02) 449-5666 (Sydney) or (03) 61-3541 (Melbourne). (J.C.)

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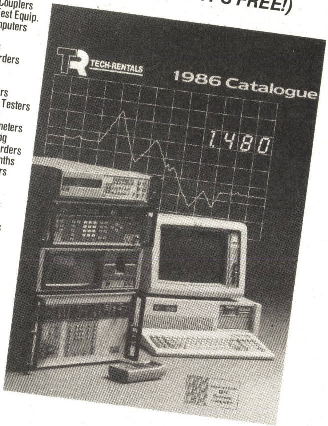

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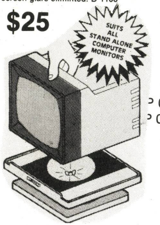
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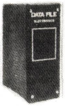

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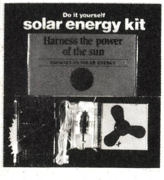

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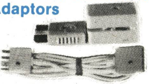

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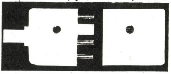

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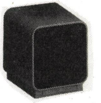

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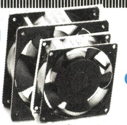

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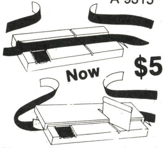

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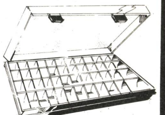

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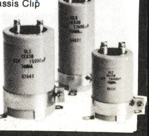

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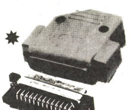

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New diesel locos have radar slip control

Using electronics to pull bigger loads

Today's high power diesel electric locomotives are using electronics to enable them to handle much larger loads than they otherwise could. The technique uses a radar doppler module to measure the true loco speed and then adjusts wheel slip to maximise tractive effort.

by JONATHON PHILLIPS

Getting freight locomotives to pull as big a load as possible is simply a matter of good economic sense. The larger the load, the lower the cost. One of the strategies being used to increase the maximum load is to add a sophisticated electronic control system to control the wheel speed.

Now, this might seem a little strange at first sight — instinct will say that the more tractive effort a loco has, the more it can pull, no matter how clever the control system. But the story is not that simple.

The major limiting factor in 'pulling ability' is the amount of friction between the wheels and rails. It's relatively easy to put a loco into a powered skid, with the wheels moving faster than the train — and if you think about what gives the loco its grip (steel against steel), it's easy to see why.

Friction is determined by a number of factors — the weight of the loco, the wheel speed along the rails (more on that later), and the state of the rail (ie, if it is oily or wet).

One approach to increasing load is to try to increase loco weight. Again, this might seem like a relatively simple matter — were it not for the fact that bridges have load limits, and that track wear also comes into the calculations.

A more subtle way of increasing pulling power is to introduce a controlled amount of "slip" into the wheel motion. Simply, this means that the wheel is always rotating slightly faster than the train motion requires, moving against the rail all the time.

Controlling wheel spin

Ever since the 1930s, a simple method has been used to control wheel speed to stop uncontrolled skid. This used a balanced relay to measure the differences in power drawn by each of the axle motors in a loco, cutting off the power if one of them started to draw significantly less current than the others (indicating a spin). At the same time, sand was applied to the rails to increase the friction.

In fact, this system is still being used in some locos, although updated with the addition of solid-state devices. Solid-state versions are known as 'second generation'.

Further refinements included multiple comparisons between the axles (each axle is usually driven by its own motor), reducing the possibility that two axles going into a spin simultaneously might not trigger the system.

But both first and second generation control systems were concerned only with cutting off the power in the event of a spin. They did not increase the load-pulling ability to any extent. That took the advent of modern control equipment, plus some studies on wheel-rail friction in the US. In the mid-70s this led to the development of the 'Super Series' control systems by General Motors.

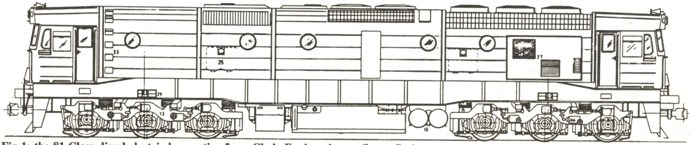

Fig.1: the 81 Class diesel electric locomotive from Clyde Engineering — Super Series control and 2461kW of power.

Picture by courtesy of the State Rail Authority of NSW.

In use in Australia today (Clyde Engineering licensed the Super Series technology from General Motors), the Super Series controls the amount of power being delivered to the motors according to a complex set of rules, which ensure that the wheels slip just enough to maximise the amount of load that can be pulled.

GM friction studies showed that the load that could be pulled by a loco was maximised when the slip reached between five and 10 percent (see Fig.2).

GM found that there were a number of other factors involved as well, which meant that the controller would have to 'know' about the motor's electrical characteristics and the effect of rail conditions. The challenge was to develop a control system that would take all of this into account.

As a result, designing the Super Series controller was a major task — it needed several man years of effort and is based around a backplane unit holding a large number of plug-in 'modules', each with a specific duty, and each of which can be replaced in the event of failure.

The designers found that the controller needed a way of establishing the actual speed of the loco (which, of course, could not be measured by finding the wheel speed). To do this, GM used a doppler radar unit mounted under the loco.

Early models used proprietary radar units manufactured outside GM, but the company later developed its own units, better suited to conditions under a train. Operating conditions in the rail industry are fairly harsh — the Super Series uses military-standard components throughout!

Having determined the actual train speed, the controller has to calculate the required wheel speed to give the optimum slip. It does this by applying a complex equation which also takes into account the average current drawn by the motors and uses an optimisation routine to adjust the amount of slip so that the average current is maximised.

Meanwhile, another part of the controller is measuring the individual motor currents. It takes note of the lowest (the one likely to be slipping the most).

Yet another function of the controller uses the lowest motor current figure to find E/N which is back-EMF divided by wheel speed. This is determined from a characteristic graph (stored inside the controller by the use of op amp window comparators, diodes, etc) of current against E/N.

E/N versus I is determined for a particular motor by calculation and/or testing, and is similar to the motor saturation curve — because loco motors are series-wound, field strength is proportional to current. Multiplying the required wheel speed by the E/N term gives the required back-EMF for the motor. This is then the required voltage for the motor.

It might then seem like a simple mat-

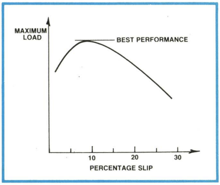

Fig.2: maximum traction occurs when the wheel slip is between five and 10 percent.

ter to adjust the supply to the motor so that it meets the required V value. Unfortunately, it's not that simple.

First, starting conditions have to be dealt with differently. This is achieved by a circuit which comes into play when the ground speed is below 2.5km/h, and allows higher slip below this.

Second, the throttle arrangement has to have its say. For a given throttle setting, there are limits on voltage, current and power, and in conditions where the rail conditions are bad, interference between the effects of throttle control and slip control can give some undesirable effects (such as the train slowing down and finally stopping on long uphill sections in the wet).

The solution to interference from the throttle control is to activate a 'sanding' mechanism when the throttle is asking for more power than the slipping wheels can get to the rail. This is an electromechanical device which simply drops sand onto the tracks in front of the wheels — an arrangement used for many years, but often controlled manually.

Wear on rails

Curiously, the use of controlled wheel slip actually reduces the amount of wear of the wheels and track, especially at the point of contact between the wheel flanges and the sides of the rail. The use of wheel slip makes the bogies 'float' on the rail, so that they can more easily take up the correct position on the rails when entering and leaving curves. The fact that the slip control system reduces the amount of sand required, by 60%, also helps reduce wear considerably.

Although the Super Series has been very successful (it is used in over 100 locos throughout Australia), it is destined to be replaced by a new microprocessor-based design currently in use in the US.

The new design uses three micros sharing a common memory, and SCRs to control the power. As well as performing in software all of the complex functions the Super Series now handles with hardware, the new controller provides fault monitoring, logging and printing.

It may seem strange that a locomotive needs such a complex control system but use of the controllers has proved more than cost-effective, increasing the amount of load that a particular loco can pull by as much as a third. EA

'81' class

Model	JT 26C-2SS	Brakes — Air	Westinghouse 26L
Power	2461kW gross. 2237kW traction	Dynamic	2520kW
Customer	S.R.A. of NSW	Drivers controls	L.H. position, multiple unit control
Road numbers	8101-8180	Cooling system	3 x 1220mm AC motor driven fans
No. in service or on order	80	Pressurisers	—
Rail gauge	1435mm	Axle boxes	SKF 152 x 279 nom roller bearing
Date first produced	1982	Axle load	206kN
Mass	129 tonnes	Power per driving axle	373kW
Wheel arrangement	Co-Co	Gear ratio	61.16
Dimensions		Wheel diameter	1016mm
Length over headstocks	19.670m	Max. permissible track speed	114km/h
Height over rail level	4.257m	Tractive effort continuous	337kN
Width over handrails	2.925mm	Special Features	Air conditioning Toilet Full width hoods on full strength underframe Super series control
Bolster centre	12.650m		
Bogie wheelbase	3.810m		
Engine	EMD 16-645E3B		
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Linearity — Automatic
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Overrange Indication — Displays OR
Function Selection — Manual via push-buttons
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Input Current — <100pA
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1k Unbalance CMR —>120dB at DC/50Hz/60Hz
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Power Requirements — 200-264V 50Hz or 94-125V 60Hz

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Δ% — Percentage deviation
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MBA 0204 - BX	0,4 Watts	0,22 Ω – 10 MΩ
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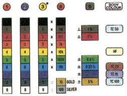
	102	102	15	150	150	22	221	221		324	324		475	475		698	698
		104			152			223	33		328			481			706
	105	105		154	154		226	226		332	332		487	487		715	715
		106			156			229			336			493			723
	107	107		158	158		232	232		340	340		499	499		732	732
		109	16		160			234			344			505			741
11	110	110		162	162		237	237		348	348	51	511	511	75	750	750
		111			164	24		240			352			517			759
	113	113		165	165		243	243		357	357		523	523		768	768
		114			167			246	36		361			530			777
	115	115		169	169		249	249		365	365		536	536		787	787
		117			172			252			370			542			796
	118	118		174	174		255	255		374	374		549	549		806	806
12		120			176			258			379			556	82		816
	121	121		178	178		261	261		383	383	56	562	562		825	825
		123	18		180			264	39		388			569			835
	124	124		182	182		267	267		392	392		576	576		845	845
		126			184	27		271			397			583			856
	127	127		187	187		274	274		402	402		590	590		866	866
		129			189			277			407			597			876
13	130	130		191	191		280	280		412	412		604	604		887	887
		132			193			284			417			612			898
	133	133		196	196		287	287		422	422	62	619	619	91	909	909
		135			198			291			427			626			920
	137	137	20	200	200		294	294	43	432	432		634	634		931	931
		138			203			298			437			642			942
	140	140		205	205	30	301	301		442	442		649	649		953	953
		142			208			305			448			657			965
	143	143		210	210		309	309		453	453		665	665		976	976
		145			213			312			459			673			988

RANGE OF VALUES	TEMPERATURE COEFFICIENTS	TOLERANCES
0 OHM – 10 MOHMS	TC 15 – TC 100	0,1% – 5%

Colour coding for Beyschlag Mini-Melf – as is usual for resistors with leads – with 4 or 5 colour bands for resistance value and tolerance.

* is not used for 4 band coding.



EXAMPLE: 37,4 KOHM ± 1% TC 50

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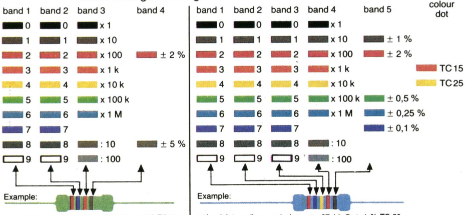
Telephone 481-950 · Telex 28801 · Telefax 481-95209

Metal Film Resistors »Harmonic Series« STANDARD	light green
Metal Film Resistors »Harmonic Series« PROFESSIONAL	light blue
Metal Film Resistors »Harmonic Series« PRECISION	light blue
Carbon Film Resistors STANDARD	ruby-red

Colour coding according to IEC Publication 62 and DIN 41 429



band 1	band 2	band 3	band 4
0	0	x 1	
1	1	x 10	
2	2	x 100	± 2 %
3	3	x 1 k	
4	4	x 10 k	
5	5	x 100 k	
6	6	x 1 M	
7	7		
8	8	: 10	± 5 %
9	9	: 100	

Example:

red - violet - orange - gold = 27 k Ω ± 5 % TC 100

band 1	band 2	band 3	band 4	band 5	colour dot
0	0	0	x 1		
1	1	1	x 10	± 1 %	
2	2	2	x 100	± 2 %	
3	3	3	x 1 k		TC 15
4	4	4	x 10 k		TC 25
5	5	5	x 100 k	± 0,5 %	
6	6	6	x 1 M	± 0,25 %	
7	7	7		± 0,1 %	
8	8	8	: 10		
9	9	9	: 100		

Example:

red - violet - yellow - red - brown = 27,4 k Ω ± 1 % TC 50

A cut out and keep Resistor colour coding chart from Crusader Electronics

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Easy-to-build unit uses pre-aligned module

UHF Converter for Channel 28

Are you one of the thousands suffering from lack of SBS programs on channel 0 because your set doesn't have UHF? Build this UHF to VHF converter and come back to the world of good TV programs, minus advertising. The circuit goes together easily and does not require any alignment or adjustments.

by LEO SIMPSON & BOB FLYNN

Since Channel 0 ceased transmissions on January 5th this year, tens of thousands of people have contacted Special Broadcasting Service offices in Sydney and Melbourne asking what they have to do to receive Channel 28. We answered these questions in detail in the December 1985 issue in an article entitled "What to do about Channel 0/28"*

In brief, if your present TV set does not have a UHF tuner, you have two choices, short of buying a new TV set incorporating UHF. First, if you have a VCR, you can use that to tune to UHF, substituting for the tuner in your TV set. (Unless your VCR is quite old, it is almost certain to include a UHF tuner.)

Second, you can buy or build a UHF adaptor. That is the reason for this article.

There are two ways of building a UHF to VHF converter. The first is to feed the UHF signal to an untuned amplifier stage and then into a mixer stage where the incoming signal is heterodyned with the tunable oscillator to produce a VHF output. This approach has the benefit of simplicity but can be very hard to tune and tends to be plagued with spurious outputs.

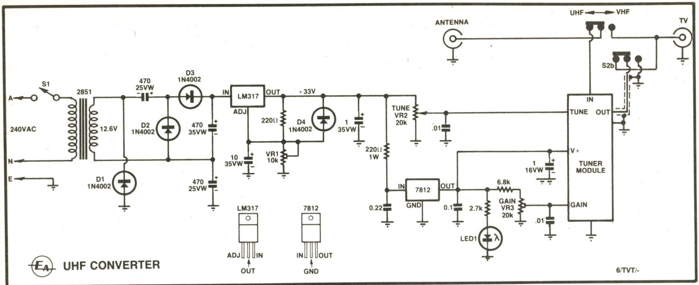
The fact that the input stage is untuned also means unwanted strong signals are prone to break through the mixer and cause interference.

The second way is to use a standard UHF tuner module which has been modified to have its output at one of the low VHF channels instead of the TV intermediate frequency of 36.87MHz. We have tried both ways and have plumped for the second because it is straightforward, requires no adjustment and is easy to tune.

We have arranged for the supply of a suitable tuner module from Dick Smith Electronics. Construction is simply a matter of installing this module on a printed circuit board, together with power supply components. The board is then assembled into a case with transformer and hardware.

Technical details

The tuner module covers both UHF bands 4 and 5 — ie, from channel 28 to 63 (526 to 820MHz) — and is a conventional varicap unit intended for use in TV sets with pushbutton station selection. In our case, it is continuously tuned by a 30-turn potentiometer which



The circuit uses a pre-aligned module and can be continuously tuned across the UHF TV band from channel 28 to 63.

feeds a DC control voltage to the internal varicaps.

Overall dimensions of the module are 93mm long, 40mm high and 25mm deep.

The output of the module is at VHF channel 1 — ie, nominally at 57.25MHz — and is via one of five PC pins along one side of the module. The other four pins are for DC tuning voltage, positive supply, negative supply, and gain control. The UHF input is via an RCA-style socket at one end of the module.

Now let us have a look at the circuit. This mainly consists of the power supply for the tuner module plus the input and output connections.

The power supply uses a small power transformer with a 12.6V secondary. This feeds a voltage tripler circuit consisting of D1, D2, D3 and the three associated 470μF capacitors. This provides an unregulated supply of about 42V DC which is fed to an LM317 adjustable 3-terminal regulator to give 33V DC. This supply is used for the varicap tuning voltage.

Note: in theory the voltage tripler circuit should give an output of about three times the peak AC input voltage or around 60V but this type of supply circuit and the specified transformer have fairly poor regulation and so the output is loaded down to around 42V.

An additional 12V 3-terminal regulator, fed from the 33V supply via a 220Ω 1W resistor, is used to power the tuner module. It also feeds the 20kΩ gain control via a 6.8kΩ resistor and the LED power indicator via a 2.7kΩ resistor.

The gain control pin for the tuner

PARTS LIST

1 PCB, code 6cv4, 107 x 92mm
1 metal box with black crinkle enamel cover, DSE Cat No H-2743 or equivalent.
1 varicap-tuned UHF tuner module with output at Australian channel 1 (available from Dick Smith Electronics)
1 power transformer with 12.6V secondary, Ferguson PF2851 or equivalent
1 DPDT slide switch
1 SPST push-on, push-off switch
2 chassis-mounting 75 Belling Lee sockets
1 RCA plug
1 2-way insulated mains terminal block
3 solder lugs
1 3-core mains cord and moulded 3-pin plug
1 cordgrip grommet or grommet and mains cord clamp

Semiconductors

4 1N4002 100PIV silicon power diodes
1 red light emitting diode and bezel
1 LM317 adjustable 3-terminal regulator
1 7812 12V 3-terminal regulator

Capacitors

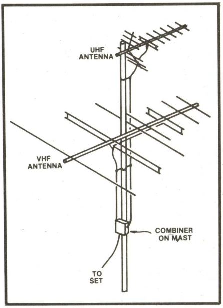
1 470μF 35VW PC-mounting electrolytic
2 470μF 25VW PC-mounting electrolytic
1 10μF 35VW PC-mounting electrolytic
2 1μF 35VW PC-mounting electrolytic
1 0.22μF 25VW ceramic
1 0.1μF 25VW ceramic
2 .01μF 50VW ceramic

Resistors

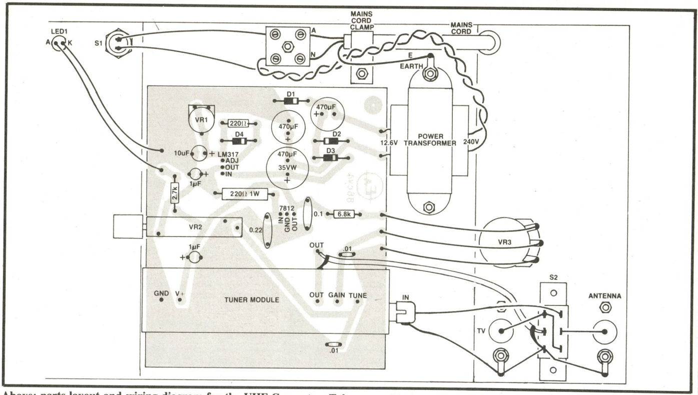
(10%, 0.5W unless stated)
1 x 6.8kΩ, 1 x 2.7kΩ, 1 x 220Ω, 1 x 220Ω/1W, 1 x 20kΩ multi-turn potentiometer with integral knob, 1 x 20kΩ linear potentiometer, 1 x 10kΩ horizontal trimpot.

Miscellaneous

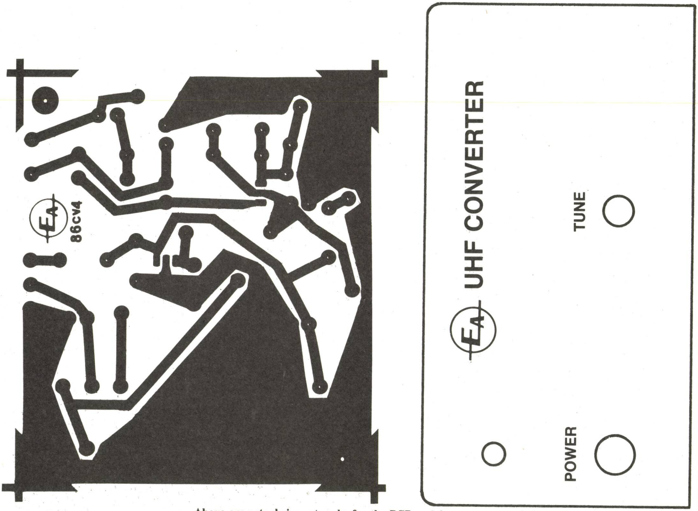
Hookup wire, 75Ω coax cable, tinned copper wire, sleeving for mains switch, screws, nuts, washers, solder.



The UHF antenna can be mounted separately or on the same mast as the VHF antenna, a metre or so above the main array. Feed the downleads to an outdoor combiner mounted high on the mast, then run a single lead to the antenna input of the UHF Converter. Use 75-ohm coax for all leads.



Above: parts layout and wiring diagram for the UHF Converter. Take care with the mains wiring.



Above are actual-size artworks for the PCB and front panel.

module is connected to a 20kΩ potentiometer which is connected to the +12V supply via a 6.8kΩ resistor. In use, the potentiometer is adjusted to give a noise-free picture.

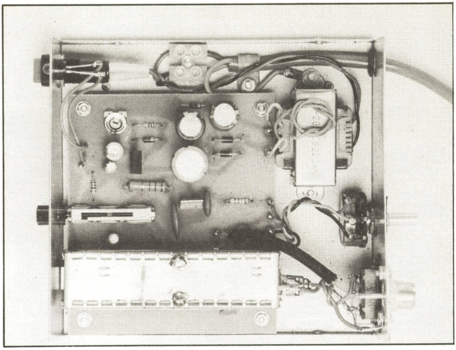
Bypass switch

The only other feature of the circuit which needs to be discussed is the bypass switch which is mounted on the rear of the case. This allows a combined UHF/VHF signal to be fed in from the antenna (or antennae) and eliminates the need to disconnect the converter when a VHF channel is being watched.

When UHF is selected, the antenna signal is fed into the tuner module and the channel 1 output appears at the "TV" socket. When VHF is selected, the antenna signal is fed straight through to the "TV" socket, bypassing the tuner module which should also be turned off.

Construction

To accommodate the tuner module and its associated components, we have designed a printed circuit board measuring 107 x 92mm and coded 86cv4. This is built into a standard metal case with inside measurements of 132mm wide, 140mm deep and 69mm high. (D.S.E. Cat. No H-2743).



View inside the prototype. Note transformer mounting location.

On the front panel, this has a push-on, push-off SPST power switch, a red power indicator LED and the small knob for the multi-turn potentiometer. On the rear panel is a pair of standard 75-ohm Belling Lee coax sockets, a slide switch for the bypass function and the manual gain control.

Assembling the board should present no problems. All the small components should be mounted and soldered first, leaving the tuner module till last. When

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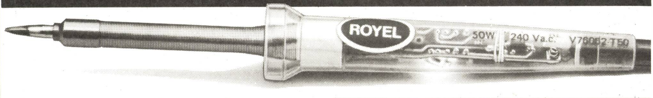

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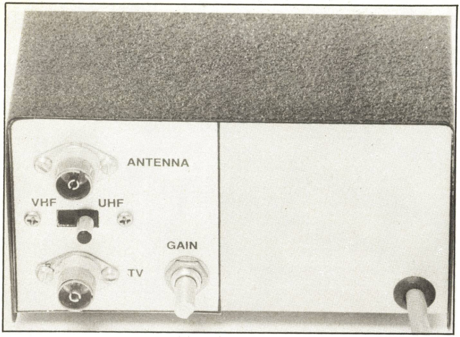


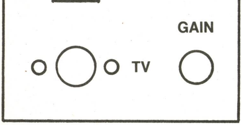
The rear panel carries the 75-ohm sockets, VHF/UHF selector switch, and gain control.

UHF Converter

soldering the module into place, solder the pins first and then the two lugs at each end of the module case. We recommend the use of PC pins to terminate external connections to the board. Eight pins are required.

When the board is complete, the case can be worked on. All the holes should be drilled before any assembly takes place. If you make or have Scotchcal front and rear panels, these can be used as a guide for the drilling of the necessary holes.

The multi-turn potentiometer is supplied fitted with its own small knob and a clearance hole needs to be drilled for this in the front panel of the case. Naturally, this will affect the mounting position of the printed board, so look before you leap.



Above: actual-size rear panel artwork.

Note: we understand that Dick Smith Electronics may supply a different multi-turn potentiometer with a value of 100kΩ. They will modify the PCB artwork to suit.

The small power transformer is mounted behind the printed circuit board but there is a problem in that one of its mounting lugs will tend to interfere with the self-tapping screw which secures the adjacent rubber foot for the case. Examination of the internal photo will show just where the transformer and other hardware is mounted.

Note that the power cord should be passed through a grommeted hole in the rear of the case and secured with a cord clamp (or use a cordgrip grommet). The mains active and neutral wires should be terminated in an insulated terminal block while the earth wire is soldered to a lug secured by one of the transformer mounting feet.

Fit insulating sleeving to the mains switch to cover the live terminals and thereby reduce the possibility of electric shock.

The VHF output from the printed circuit board to the bypass switch should be made via a 7cm length of shielded cable. The shield should be terminated at both ends: at the bypass switch end, as shown on the wiring diagram and at the board end, by soldering onto the case of the tuner module.

Since the distance from the input socket of the tuner module to the bypass switch is so short, it is not practical to use shielded cable. Instead, an RCA plug should be connected to the appropriate terminal of the bypass switch using a short length of hookup wire. This can be twisted together with the earth return wire from the RCA plug to the solder lug for the "Antenna" socket on the rear of the case.

When assembly is complete, check all your work carefully. Set VR1 so that the wiper is at mid-travel. Then apply power and connect a multimeter, set to its 50V DC range, between the anode of D4 (ie, the output of the LM317) and the earth return pin for the LED. Now adjust VR1 for a reading of +33V on the multimeter.

Set gain control VR3 to its midway position and connect the converter between your antenna lead and TV set. Now comes the tricky part. You have to tune your TV set to channel one and the converter to channel 28. As a first step, rotate the multi-turn tuning potentiometer VR2 for the converter fully anti-clockwise.

You do this by rotating the knob umpteem times anti-clockwise until it comes to the click stop. This sets the converter to the bottom of UHF band four, which is where channel 28 sits. Now rotate the potentiometer about two turns clockwise which for our unit was not too far away from optimum tuning for channel 28.

Now select channel 1 on your TV set and use the fine tuning control to obtain the best picture. This will involve a "hunt back and forth" job as you tweak the TV fine tuning control and the converter tuning potentiometer, to obtain the best picture.

That done, rotate the gain control, VR3 anticlockwise until noise (snow) appears in the picture. Now rotate VR3 clockwise until the noise just disappears. That completes the setting up adjustments. You can now enjoy SBS programs.

Note: if your local SBS channel is on one of the band five channels, the above procedure is much the same except that the setting for the tuning control will be more towards mid-travel.

*If you missed our article in the December 1985 issue, photostat copies are available for $4.00 including postage. Write to the Assistant Editor, Electronics Australia, PO Box 227, Waterloo, NSW 2017.

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An introduction to hifi Pt 3

HIFI facts & figures

decibels, distortion, dynamic range &c.

In this chapter we have a look at some of the main parameters used to describe hifi equipment: frequency response, harmonic and intermodulation distortion, dynamic range and power output. We introduce decibels too, which are most important for an understanding of hifi performance figures.

by NEVILLE WILLIAMS

Beginning with frequency response, the components of a high fidelity sound system, and the system as a whole, should logically exhibit a substantially "flat" frequency response for all frequencies over the potentially audible range. This is commonly rounded out in hifi literature, these days, to "flat from 20Hz to 20kHz".

We say that hifi components should "logically" exhibit this flat response but not all hifi components do. For example, most FM tuners can only be expected to be flat from 20Hz to 15kHz and even wideband AM tuners are usually not even as good as this. We shall discuss the reasons for this in detail later in this series.

For the moment though, let us agree that "flat from 20Hz to 20kHz" is the normal standard we expect from high fidelity components. Anything less than this might be regarded as "medium hifi" or even "adequate hifi" but not "genuine hifi". (See Fig.1).

Graphs & decibels

The notion of frequency response being "flat" (or otherwise) can be depicted in a graph in the general form of Fig.2, showing the relative output of an audio stage, component or system along the vertical axis, plotted against frequency on a logarithmic scale along the horizontal axis.

While the vertical (output) scale appears at first glance to be linear, the units (decibels) are logarithmic, preferred because they relate more naturally to the logarithmic response of the human ear. (See Chapter 1).

Whether in an acoustic context, as in the earlier chapter, or electrical as here, a power ratio can be converted to decibels by determining the log (to the base 10) of that ratio, multiplying it by 10 and calling the result dB. In the case of voltage ratios, the log is multiplied by 20 instead of 10, to allow for the fact that power varies as the square of the voltage.

For those not familiar with logs, Table 1 shows power and voltage ratios, and their decibel equivalents, over the range most frequently encountered in audio graphs: from +30dB, through 0dB (reference) to −30dB.

If, under test, the output from a piece of audio equipment (for a given input) does not vary perceptibly across the entire audio spectrum, the response "curve" would be a "flat" horizontal line, (a) in Fig.2, from 20Hz to 20kHz, drawn (normally) at the 0dB reference level.

In some modern components such as CD players and power amplifiers, the frequency response may be either flat or so close to it that a graph is scarcely warranted. The information can be conveyed in the specifications in a few words: "Frequency response: flat from 20Hz to 20kHz"; or "Frequency response: 20Hz to 20kHz, +0 −1dB."

By contrast, curves (b) and (c) convey quite detailed information representing (b) the natural response of a magnetic phono cartridge playing an ordinary record and (c) the requisite response of a compensated phono preamplifier stage to provide a nominally flat overall frequency characteristic. A −18dB (approx) response from the cartridge at 30Hz is compensated by +18dB from the preamplifier, and so on across the spectrum.

Curves (b) and (c) emphasise the advantage of decibel notation: By simply noting the dB response of individual components in the record/replay chain, it is possible to predict the likely overall response pattern by simple addition and subtraction.

Subjective reactions

As previously stated, subjective tests have established that the smallest change in audio power level that listeners can detect under controlled conditions is about 1.6 times or 2dB.

On this basis, individual components in a sound reproducing system might reasonably be considered to have a subjectively flat frequency characteristic if their response does not deviate beyond a tolerance "window" about 2dB wide (eg ±1dB).

Many would dispute this, however, claiming that even a 0.5dB deviation over a portion of the frequency characteristic can make a subtle difference to the balance of the sound.

Whether or not this is making too fine a point for the average hifi enthusiast, the flattest possible characteristic is certainly desirable, if only to ensure that ostensibly small deviations in individual components don't add up to a sizeable prominence, or trough, or roll-off in the overall response, sufficient to affect the tonal balance of the system. (See Fig.3).

At the low frequency end, an overall response tapering downwards through, say, −10dB at 50Hz would cause a loss of real "weight" in orchestral or organ music. Conversely, a rising or peaked response in the 60-110Hz region would produce an unnatural "thumping" bass — perhaps not out of place with "pop" music!

At the high frequency end, a rising response in the 5-12kHz region can result in a strident or "edgy" quality while a falling response can rob instruments of their natural harmonics producing, instead, an unmusical "mellow" uniformity in their sound.

A too-prominent middle response (2-5kHz) can impart a flattering "presence" to solo voices and instruments, and even to chamber groups, but this is at the expense of an overall balance on a full orchestra. A lack of middle response, on the other hand, can heighten the impression of dispersed, wide-range sound, but may impart a sense of remoteness, as distinct from presence, to solo voices and instruments.

There is something suspect about equipment which sounds good on one kind of program but poor on another. A good system will not tend to favour any particular class of sound or instrument at the expense of the rest!

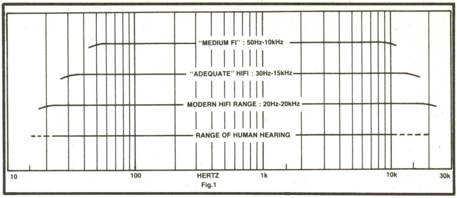

Fig.1: The desirable frequency range for modern hifi equipment is normally considered to be flat, or substantially so, from 20Hz to 20kHz. Some components are still limited to the "adequate" range.

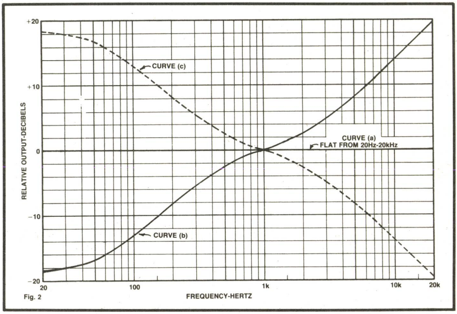

Fig.2: A typical group of frequency curves: (a) is flat from 20Hz to 20kHz; (b) is the nominal frequency characteristic of a magnetic phono cartridge, while (c) shows the required response for a phono preamplifier. Together, (b) and (c) would provide a flat response overall.

DECIBELS (dB)	POWER RATIO	VOLTAGE RATIO	DECIBELS (dB)	POWER RATIO	VOLTAGE RATIO
+30	1000	31.62	0	1.0	1.0
+25	316	17.78	-1	.79	.89
+20	100	10.00	-2	.63	.79
+19	79.43	8.91	-3	.50	.71
+18	63.10	7.94	-4	.40	.63
+17	50.12	7.08	-5	.32	.56
+16	39.81	6.31	-6	.25	.50
+15	31.62	5.62	-7	.20	.45
+14	25.12	5.01	-8	.16	.40
+13	19.95	4.47	-9	.13	.35
+12	15.85	3.98	-10	.10	.32
+11	12.59	3.55	-11	.08	.28
+10	10.00	3.16	-12	.06	.25
+9	7.94	2.82	-13	.05	.22
+8	6.31	2.51	-14	.04	.20
+7	5.01	2.24	-15	.032	.178
+6	3.98	1.99	-16	.025	.159
+5	3.16	1.78	-17	.020	.141
+4	2.51	1.58	-18	.016	.126
+3	1.99	1.41	-19	.013	.112
+2	1.59	1.26	-20	.010	.100
+1	1.26	1.12	-25	.003	.056
0	1.00	1.00	-30	.001	.032

Table 1: Showing equivalent power and voltage ratios from +30 to −30dB, this covers the range most commonly encountered in performance curves. Check it against your own log tables.

HIFI facts & figures

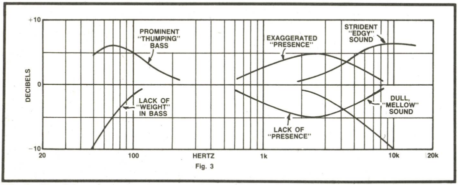

Fig. 3

Fig.3: Possibly unsuspected, prominences and/or dips in the overall frequency response of a system can affect the sound in various ways, as shown.

Distortion: a closer look

"Distortion" is a term which could conceivably refer to any shortcoming in the reproduced signal, due to a technical imperfection. However, unless otherwise indicated, it normally refers to "harmonic" distortion, a particular form of "non-linear" distortion, resulting from non-linearity in the signal path through the reproducing system. Let's look at this in greater detail:

Envisage an audio frequency sine wave being fed from a signal source (CD, phono, tape, &c) through an amplifier to a loudspeaker, and being subsequently evaluated with the aid of a microphone and electronic test equipment.

With a perfect system, the signal would be a pure sine wave at all stages, with no deviation from its mathematically based contour and therefore no distortion in terms of wave shape.

However, in practical, as distinct from perfect equipment, the input/output relationship may not be completely linear, resulting in some discrepancy between the output and input waveforms.

This holds true both for electronic components and for transducers where, at the input end of a system, the signal is being recovered from a mechanical, optical or magnetic pattern and, at the output end, converted into acoustic energy.

Spurious harmonics

Waveforms affected by non-linearity have actually acquired spurious frequency components superimposed on the original signal. And, because the waveform distortion is repeated in successive cycles, the spurious components are harmonically related to — and therefore multiples of — the signal frequency.

Thus, if a 1kHz sine wave is subjected to non-linear processing, it will acquire spurious harmonics, for example: a second harmonic at 2kHz, a third harmonic at 3kHz, a fourth at 4kHz and so on.

Fig.4 should serve to illustrate the effect of non-linear processing on a signal passing through an audio component. In each example, an input sine wave is plotted vertically, while the resultant output waveform is to the right of the input/output transfer curve.

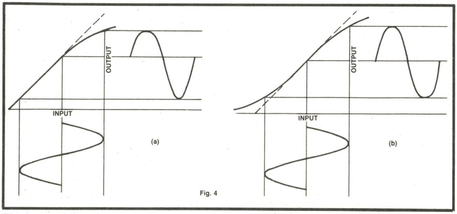

Fig. 4

Fig.4: Any hint of non-linearity in the transfer characteristic will result in harmonic and intermodulation distortion, gross as in the illustration, or small but subtle in good quality audio equipment.

With a linear transfer characteristic (shown dotted) the output would be a sine wave, free from harmonic distortion.

However, in (a) the transfer characteristic deviates from linear at one end while, in (b) the characteristic is S-shaped. Both are exaggerated in the drawing for purposes of illustration but both conditions are encountered to some degree in practical electronic amplifiers and transducers.

In (a), one excursion of the output wave is compressed and analysis would normally show that it has acquired a percentage of predominantly even order harmonics: second, fourth, sixth, &c. In (b), both excursions are compressed and the harmonic structure would be predominantly an odd number: third, fifth, seventh, &c.

While it is possible to measure the amplitude of individual harmonics, engineers more commonly use a "Distortion Factor Meter" to indicate the sum of all the spurious components present: actual harmonics plus any noise contributed by the equipment under test.

Described (somewhat loosely) as the total harmonic distortion (or THD), the indicated sum is expressed as a percentage of the total output. Fairly obviously, the lower the figure, the better is the linearity (and the lower the noise content) of the particular component.

Laboratory test procedures are based on a sine wave input signal as the most practical method but complex signal waveforms are affected by non-linearity in a similar manner, the difference being that every single frequency present in a program signal may acquire its own array of spurious harmonics!

Levels of distortion

In days when the standard of sound reproduction was determined mainly by AM radio and 78rpm records, a comparatively high degree of non-linear (therefore harmonic) distortion was tolerated, even in better quality equipment — often amounting to several percent.

The level of distortion in modern, good quality equipment is very much lower, and, instead of several percent, is more likely to be around 0.1% with some components such as CD players and high quality amplifiers, exhibiting less than .01%.

It is not possible to nominate any single figure for THD which reliably represents the borderline between what is

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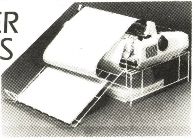

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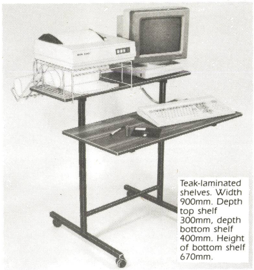

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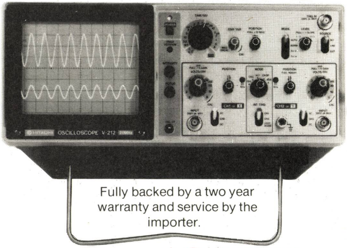

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HIFI facts & figures

subjectively objectionable and subjectively tolerable. Much depends on the circumstances.

At the low fequency end a loudspeaker, for example, may exhibit several percent of second and/or third harmonic distortion when driven at 20-40Hz. In the guise of musical harmonics, the spurious components may significantly modify the nature of the sound, without being recognised as distortion.

At the high frequency end, phono pickups may produce mis-shapen waveforms — therfore harmonics — due to poor tracking above about 6kHz. But, because many such harmonics lie above 12kHz, they are not heard by most listeners.

Again, low order "spurious" harmonics, may be perceived as natural, harmonics of solo (notably brass) instruments, modifying their timbre without necessarily being interpreted as distortion.

Yet, in other circumstances, similar percentages of distortion could prove totally objectionable. Clearly, a high quality sound system should be able to reproduce all the complex harmonics and subtle overtones that are contained in the original signal but, ideally, should not add any of its own.

Intermodulation effects

As distinct from the generation of harmonics, non-linearity also causes signals which are being handled simultaneously to intermodulate, producing additional sum and difference frequencies. For example, signals at say, 400 and 700Hz could intermodulate to produce resultants at 7400 and 6600Hz — both totally dissonant in terms of the original tones.

Intermodulation distortion ("IMD") becomes progressively more noticeable — and objectionable — with more complex signals, and is blamed for much of the "congestion" or "muddiness" that can compromise orchestral or choral recordings. It may be less noticeable on the same equipment playing solo or chamber music.

The percentage of IMD, as measured and specified, depends on the nature of the non-linearity and on the test conditions. It may come out at about the same figure as the measured THD, or it may be 3 or 4 times higher.

Again, it is not possible to nominate any one figure representing the borderline between a tolerable level of IMD and otherwise. The objective can only be to aim for the lowest possible figure for any given type of component.

Dynamic range

In the context of hifi sound reproduction, dynamic range might be defined as the ratio, expressed in decibels, between the softest and loudest sounds which occur at a performance, or are effectively transmitted or recorded and reproduced, or are capable of being heard in a particular listening environment.

By way of example, as measured on a sound level meter in a (relatively) quiet concert hall, the SPL (sound pressure level) readings of a large symphony orchestra may range from about 30dB during the softest passages (ppp) to about 100dB at the other extreme (fff) — a dynamic range of up to 70dB.

Over the years, this has served as something of a target figure for recording and reproducing components and/or systems: the ratio between the signal level at the overload threshold and the intrinsic noise level of the component or system should be at least 70dB. (See Fig.5).

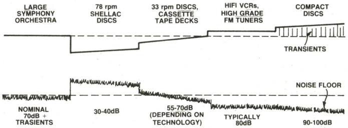


Fig. 5

Fig.5: In the past, record/replay equipment has been unable, or barely able, to cope with a realistic dynamic range. Compact discs in particular can cope with transients, as well as the main body of the sound.

Mainly because of high surface noise, 78rpm shellac pressings were limited to 35-40dB, making it necessary for recording engineers to constantly monitor the signal to keep it within manageable levels.

With much lower surface noise, vinyl pressings offered an immediate 55dB but this figure has gradually been improved upon by better mastering technology and the development of phono cartridges and preamplifiers able to cope with higher groove modulation.

According to their jacket notes, many audiophile orchestral recordings are now made without any level adjustments during the performance, indicating a dynamic range of up to 70dB — and possibly higher in special cases.

Cassette tape equipment has undergone somewhat similar development in respect to in-home recording and replay, thanks to the emergence of improved heads, beter tape formulations and the inclusion of noise reduction systems such as Dolby-B/C, and dbx.

In the realm of broadcasting, FM-stereo can also make available programs with a similar order of dynamic range, given suitable source material, a good tuner and reasonable reception conditions.

A potential problem

Even before the arrival of compact discs and hifi VCRs, the availability of program sources with 70dB or more of dynamic range had highlighted a problem in accommodating the resulting volume levels in the average home.

It may have come as a surprise, in chapter 1, to learn that the ambient noise in a typical suburban living room has a subjective loudness level of around 40dB. If the softest sounds are set to this nominal level, so as not to be unduly masked by the noise, it follows that the loudest orchestral passages could reach a not inconsiderable 110dB at the listening position. The implications are obvious enough:

- The selected listening room must be as quiet as possible so that the ppp passages can be set to a commensurately low level.
- So as not to compound the situation, the reproducing equipment should contribute as little noise of its own as possible, yet still be capable of delivering adequate power on peaks, without perceptible overload.
- Where high peak levels are domestically unacceptable, it may be necessary to use headphones on occasions,

or to rearrange the loudspeakers to permit closer listening.

Still higher figures?

If the dynamic range of modern "black" discs, for example, is as much as we need, or can accommodate in the home, where lies the advantage of a still higher figure from hifi VCRs and up to nearly 100dB from CD players? A good question!

In fact, the capacity for greater dynamic range does not indicate that there is any thought of encouraging orchestras to exploit the new dynamic limits — ppp and fff!

The immediate value of the new technology is that it makes it possible for even the softest sounds to be recorded well above the so-called "noise floor" of the record/replay system while, at the same time, ensuring that the loudest sounds fall well below the overload region.

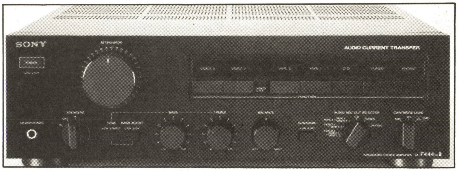
The benefit becomes apparent when listening to a digitally mastered compact disc. Even as heard in the ambience of an ordinary listening room, the sensation has frequently been described as "one of listening to sound out of silence". And, in the loudest passages, there is no hint of stress, due to impending mechanical or magnetic overload.

But another important factor has emerged, to do with the transients associated with percussive musical sounds as, for example, those from an acoustic guitar.

Such transients, which impart "attack" to the notes, can have a quite high amplitude but, because they are of brief duration, they do not register on a conventional sound level meter, nor do they add greatly to the subjective loudness of the sound.

In fact, they tend to be "crushed" by conventional analog tape master recorders, and audiophiles only became aware of what they were missing, with the release of "direct cut" and digitally mastered discs, having greater dynamic range and the ability to accommodate fleeting transient peaks.

And there lies the further advantage of those extra decibels of dynamic range: not just greater freedom from noise and from congestion on loud passages, but the ability to preserve transient peaks on which depends much of the attack and "vitality" of reproduced sound. At stake is not louder sound but better sound!



Boasting a power output of 100W RMS per channel, Sony's TA-F444ESII is typical of modern up-market stereo amplifiers. Its frequency response is 2Hz-200kHz (±0.2dB) while total harmonic distortion is just .004% at rated output.

Power output

As we shall see later, the preservation of transient peaks on modern recordings makes extra demands on the amplifier and loudspeaker system but, even apart from this, amplifier power output is subject to a good deal of misunderstanding.

In the laboratory, the basic test for power output involves connecting a stereo amplifier to a pair of high wattage resistors instead of the usual loudspeakers, each resistor being equal in value to the recommended load, typically 4 or 8 ohms, and rated to dissipate at least as many watts as the anticipated power output of the respective channels.

A 1kHz signal is then fed to the input of both channels and gradually increased in amplitude until the amplifiers are on the threshold of overload as displayed on an oscilloscope or, more precisely, indicated by a distortion meter showing that the THD has reached a pre-determined level.

The RMS voltage (E) across the load (R) is then measured and the mathematical average power (P) for each channel calculated on the basis that:

$P = E^2/R$

Assuming that both channels are symmetrical, the procedure will yield a figure which is variously described as the "RMS" (strictly a misnomer) or "continuous" or "steady tone" power output, per channel, both channels driven.

A complication arises because, with most amplifiers, a continuous tone test places a heavy load on the power supply, causing a reduction in supply voltage to the output stage(s), with a consequent reduction in their power output.

Being of a more spasmodic nature, even loud program signals do not affect the supply voltage to the same extent and the maximum power available on program material — the so-called "music power" — may typically be around 20% higher than the "average" or "continuous" rating, and therefore a more flattering figure to publish.

However, largely as the result of pressure from the Federal Trade Commission and the Institute of High Fidelity in the USA, and from their European counterparts, amplifier manufacturers are now obliged to publish a continuous rating for their equipment, with all channels driven.

They may, if appropriate, quote a music power rating based on test procedures approved by the IHF. Or they may quote a figure for "headroom" in dB, the margin of power available above the continuous rating to handle program type signals. Referring back to Table 1, a mere 1dB of headroom would represent an increase in power level of 26%

The purpose of publishing a "continuous" power rating is to ensure that buyers will be aware of the minimum power available from a stereo amplifier under the most onerous program drive conditions — eg a concert organ at full volume with sustained pedal bass.

If this minimum figure is reckoned to be adequate, extra output by way of music power becomes a bonus. (We will have more to say about appropriate hifi power levels in a later chapter on amplifiers.)

But just a note of warning: Some manufacturers of inexpensive, non-hifi equipment have jumped on the bandwagon by quoting "Peak music power" — obtaining the figure by using the peak rather than the RMS value of the output wave in the above formula, thereby doubling the answer. Not only that, but they add the output of the left and right stereo channels to give them "Total peak music power".

As a result, a humble 5+5W (continuous) amplifier, can become 6+6W music power, or 12+12W peak music power or an impressive sounding 24W total peak music power! So don't be misled.

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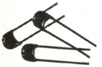

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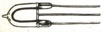

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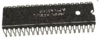

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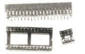

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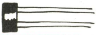
IN4002 Cat.Z10150	**4¢**	**3¢**	**2½¢**	**3¢**
IN4004 Cat.Z10107	**5¢**	**4¢**	**3¢**	**2½¢**



BRIDGE SPECIALS

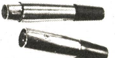
	1-9	10+	100+
WO2 1.5A 200V Cat. Z11030	**28¢**	**26¢**	**24¢**
WO4 1.5A 400V Cat. Z11032	**30¢**	**28¢**	**26¢**

RS232 & 'D' TYPE CONNECTORS

PART	DESCRIPTION	CAT. No.	1-9	10+
DE 9P	9 Pin Female	P10880	**$1.75**	**$1.60**
DE 9S	9 Pin Male	P10881	**$2.25**	**$2.45**
DE 9C	9 Pin Cover	P10992	**$2.55**	**$2.45**
DA 15P	15 Pin Male	P10894	**$2.10**	**$1.95**
DA 15S	15 Pin Female	P10895	**$2.25**	**$2.10**
DA 15C	15 Pin Cover	P10892	**$1.15**	**$1.05**
DB 25P	25 Pin Male	P10900	**$1.95**	**$1.80**
DB 25S	25 Pin Female	P10901	**$2.95**	**$2.70**
DB 25C	25 Pin Cover	P10902	**$1.20**	**$1.10**

IDC SOCKETS

Cat. No.	Description	Price
P12100	10 pin IDC socket	**$2.50**
P12101	16 pin IDC socket	**$3.00**
P12102	20 pin IDC socket	**$3.75**
P12103	20 pin IDC socket	**$3.95**
P12104	34 pin IDC socket	**$4.95**
P12106	34 pin IDC socket	**$4.95**
P12108	40 pin IDC socket	**$5.25**
P12110	50 pin IDC socket	**$6.95**



CANON TYPE CONNECTORS

Cat. No.	Description	Price
P10960	3 pin line male	**$3.90**
P10962	3 pin chasis male	**$3.00**
P10964	3 pin line female	**$4.20**
P10966	3 pin chasis female	**$4.50**

RUBBER FEET (STICK ON)

Cat. No.	DESCRIPTION	PRICE
H10941	16mm Pkt 25	$3.95
H10942	16mm Pkt 100	$11.95
H10950	20mm Pkt 4	$0.99
H10951	20mm Pkt 25	$3.95
H10952	20mm Pkt 100	$13.95

RUBBER FEET (SCREW ON)

at. No.	Description	Price
H10913	13mm Pkt 8	**$0.95**
H10914	13mm Pkt 25	**$2.95**
H10915	13mm Pkt 100	**$9.95**
H10916	16mm Pkt 8	**$1.20**
H10917	16mm Pkt 25	**$2.95**
H10918	16mm Pkt 100	**$10.95**

RECHARGEABLE 12V GELL BATTERIES

Leakproof and in 3 convenient sizes, these long service life batteries are ideal for burgular systems, emergency lighting or as a computer backup power supply. Ideal for many power needs.

Cat. S15029	12V 1.2 AH	**$12.95**
Cat. S15031	12V 2.6 AH	**$39.50**
Cat. S15031	12V 4.5 AH	**$49.95**

BRAND NEW FANS

Not noisy pullouts! Stacks of uses in power amps, computers, hotspot cooling etc. Anywhere you need plenty of air.

240V	4⅝"	Cat. T12461	**$12.95**
115V	4⅝"	Cat. T12463	**$12.95**
240V	3½"	Cat. T12465	**$12.95**
115V	3½"	Cat. T12467	**$12.95**

10+ fans (mixed) only $10 each!

CENTRONICS

Cat. No.	Description	Price
P12200	36 way plug IDC	**$12.50**
P12201	36 way skt IDC	**$13.50**
P12203	50 way plug IDC	**$14.50**
P12204	50 way skt IDC	**$15.50**
P12207	24 way solder plug	**$12.90**
P12210	36 way solder plug	**$ 9.50**
P12211	36 way sldr line skt	**$15.95**
P12213	36 way sldr chss skt	**$15.95**

10W HORN SPEAKERS

White durable plastic, 8 ohms
Cat. C12010

1-9	10+
$9.95	**$8.95**

RCA GOLD PLATED PLUGS AND SOCKETS

For those who need the ultimate in connection. Essential for laser disc players to get that fantastic sound quality.

Plug Cat. P10151	**$3.50**
Socket Cat. P10150	**$2.75**

4½ DIGIT LCD UNIVERSAL COUNTER C7224

- **Very Low Power**
- **High Count Rate**

A 4½ digit counter offering counting to 20,000 units at rates up to 10MHz. The low current consumption makes it ideal for use in portable instruments. The counter features high contrast 10mm digits, 5V DC or 7.5V to 15V DC supply (typical consumption 1mA), and programmable decimal points. Standard controls are all TTL/Cmos compatible and include Reset, Count, Inhibit, Store, Leading Zero Blanking, 'Carry' Output. The count input is protected against accidental overload. Supplied complete with mounting kit and connectors.

SPECIFICATIONS:
Supply Voltage: (5.5V Abs. Max.) 7.5 - 15V
Typical Current Consumption: 1mA
Maximum Count: 19999
Max. Counting Rate: 10MHz
Typical (Schmitt Trigger):
Count Input Level: VTH 2.5V VTL 2V
Min. DC Input Level: 0V
Max. DC Input Level: 5V
Operating Temp. Range: 0 - 50°C
Cat. Q15530 **$119.95**

3½ DIGIT ECONOMY LCD CPM

- **Ultra-Low Power**
- **Bandgap Reference**

An ultra-low power, extremely stable LCD CPM suitable for a wide number of different applications. Features Auto-zero, Auto-polarity, 200mV fsd, User adjustable Low Battery indication, 12.5mm digit height, programmable decimal point. The QP-5513 has an external bandgap reference for extra temperature stability, with connections brought out, allowing use in single ended, differential or ratiometric mode. The fsd can be easily rescaled by the user to indicate volts, amps, ohms or many other engineering units. Supplied with a beezel mounting, clips, connectors and full data sheet.

SPECIFICATIONS:
Accuracy: 0.1% + − 1 count
Linearity: + − 1 count
Samples/sec: 3
Temp. Stability: 50 ppm typical
Temp. Range: 0 - 50°C
Supply Voltage: 5 - 15V DC
Supply Current: 200uA typical
Max. DC Input Voltage: + − 20V
Cat. Q15513 **$69.95**

VIDEO RF MODULATOR

At an unbelievable prices! Our RF modulators are channel selectable either Channel O or Channel 1.
Cat. S16040

1-9	10+
$3.95	**$2.95**

10,000uF 75V ELECTROS

25% more microFarads! Ideal for those who want a more powerful amp!

	1-9	10+
Cat. R16587	**$14.95**	**$12.95**

4½ DIGIT LCD DPM 60

- **200mV fsd**
- **Digital Hold**
- **Bandgap Reference**
- **10uV Resolution**

A new 4½ digit LCD DPM offering levels of performance, low current consumption and compact size never previously available. The DPM-60 features Auto-zero, Auto-polarity, a logic switched 200mV or 2V fsd, Digital Hold, programmable decimal points and a 1mA current consumption. Automatic low battery indication and 'continuity' flags are built into the 10mm 4½ digit display. The DPM 60 can be readily rescaled by user to indicate many different units, amps, volts, ohms etc. Supplied complete with fixing bezel, clips and connector, the DPM 60 will suit many applications calling for low-cost, high accuracy measurements in portable instruments or bench instruments.

SPECIFICATIONS:
Accuracy: 0.01 m+ − 1 digit
Linearity: + − 1 digit
Samples/sec: 1.6
Temp. Stability: 50 ppm/°C typical
Temp. Range: 0 - 35°C
Supply Voltage: 7.5 - 15V
Supply Current: 1mA typically
Max DC Input Voltage: + − 20V
Cat. Q15520 **$149.95**

DPM-200 PANEL METER

- **Ultra Low Power**
- **Separately Addressable Annunciator**
- **15mm Digits**
- **Bandgap Reference**

A low profile LCD DPM with a range of useful symbols as shown. The DPM 200 features 15mm 3½ digit display, and ultra low current consumption and a bandgap reference for high stability. It also features Auto-zero, Auto-polarity, 200mV fsd. It may be used in single-ended, differential or ratiometric modes. The fsd can be easily changed by the user to indicate any other units. The decimal points and symbols can all be driven from an internal source. Wide supply and symbols can all be driven from an internal source. Wide supply rail (5-15V DC) with a variable threshold low battery warning indicator. Supplied with mounting clips and comprehensive data sheet.

SPECIFICATIONS:
Accuracy: 0.1% + − 1 digit
Linearity: + − 1 digit
Samples/sec: 3
Temp. Stability: 50 ppm typical
Temp. Range: 0 - 50°C
Supply Voltage: 5 - 15V DC
Supply Current: 50uA typical
Max DC Input Volts: + − 20V
Cat. Q15510 **$99.95**

CENTRONICS CONNECTORS
½ PRICE!!!
DURING APRIL!

3 HOUR VIDEO TAPES

1-9	10-24	25+
$7.95	$6.95	$5.95

ATTENTION BARGAIN HUNTERS
We'll give you 5% off all our regular prices if you present this advertisement to our shop staff during April!
(This offer applies only to our regular prices and not to advertised or special prices.

compliments of Rod Irving Electronics

HOOK UP WIRE

Cat. No. Description
W11251 13/.12 TND BLK
W11252 13/.12 TLD BROWN
W11253 13/.12 TLD ORANGE
W11254 13/.12 TLD YELLOW
W11255 13/.12 TLD GREEN
W11256 13/.12 TLD BLUE
W11257 13/.12 TLD WHITE
PRICES PER 100 METRE ROLL

1-9	10+
$5.95	$5.00

W11260 14/.20 RED
W11261 14/.20 BLACK
W11265 14/.20 BLUE
W11268 14/.20 WHITE
PRICES PER 100 METRE ROLL

1-9	10+
$12.00	$10.00

W11270 24/.20 RED
W11272 24/.20 BLACK
W11274 24/.20 GREEN
PRICES PER 100 METRE ROLL

1-9	10+
$14.00	$12.00

W11280 32/.2 BROWN
W11282 32/.2 BLUE
PRICES PER 100 METRE ROLL

1-9	10+
$20.00	$18.00

RAINBOW CABLE

Suitable for IDC connectors.

Cat.No.	Description	$/metre
W12714	28AWG 14W	$1.80
W12716	28AWG 16W	$1.80
W12720	28AWG 20W	$2.20
W12726	28AWG 26W	$2.90
W12734	28AWG 34W	$3.60
W12740	28AWG 40W	$4.40

BULK CABLE 100M ROLLS

Cat. W11222 3C2V 75 OHM	$22
Cat. W11224 5C2V 75 OHM	$35
Cat. W11219 4 Core Shielded	$49

JOINABLE PCB MOUNTING SCREW TERMINALS (GREY)

2 Way	1-9	10+
Cat. P10520	$0.75	$0.69
3 Way		
Cat. P10521	$0.95	$0.85

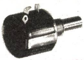
12 WAY TERMINAL BLOCKS

P18050	240V	10AMP	$1.50
P18052	240V	15AMP	$1.75

FUSE SPECIAL 3AG

Two values, 3 Amp and 1 Amp

1-99	100-999	1000+
8¢ each	6¢ each	5¢ each



10 TURN WIRE WOUND POTENTIOMETER

Spectrol Model 534
¼" shaft.
Equiv (Bourns 3540S, Beckman 7256)
Dials to suit 16-1-11, 18-1-11, 21-1-11.

R14050	50R	R14100	5K
R14055	100R	R14110	10K
R14060	200R	R14120	20K
R14070	500R	R14130	50K
R14080	1K	R14140	100K
R14090	2K		

1-9	10+
$13.50	$12.50

SPECTROL 43P

Equiv (Bourns 3006)
Essential for precision work.

R14200 10R	R14290 10K
R14210 20R	R14300 20K
R14220 50R	R14310 50K
R14230 100R	R14320 100K
R14240 200R	R14330 200K
R14250 500R	R14340 500K
R14260 1K	R14350 1M
R14270 2K	R14360 2M
R14280 5K	

1-9	10+
$1.95	$1.75

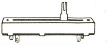
QUALITY LEDS

Cat. No.	Description	Price
Z10140	3mm Red	$0.20
Z10141	3mm Green	$0.30
Z10143	3mm Yellow	$0.30
Z10145	3mm Orange	$0.30
Z10150	5mm Red	$0.15
Z10151	5mm Green	$0.30
Z10152	5mm Yellow	$0.30

MINI JUMPERS

- Contact terminal: Phospor bronze
- Material: P.B.T. 94V-0
- Gold plated

Qty	Cat. No.	Price
10	P12053	$ 2.95
25	P12055	$ 4.95
100	P12057	$21.95



LOG SLIDES POTS

We ordered log instead of linear for the graphic equalizer, so take advantage of our mistake!

1-9	10+	100+
$0.65	$0.60	$0.50

VOLTAGE REGULATORS BARGAINS

Description	1-9	10+
LM309KC	$1.80	$1.60
7805KC	$1.80	$1.60
7812KC	$1.80	$1.60
78H05KC 5V 5A	$7.80	$6.95
78H12KC 12V 5A	$7.80	$6.95

EVERY DAY LOW PRICES!

We have a great range of panel meters at great prices!

Cat.No.	Description	Price
Q10500	MU45 0-1mA	12.50
Q10502	MU45 50-0/50uA	12.50
Q10504	MU45 0-100uA	12.50
Q10510	MU45 0-5A	12.50
Q10518	MU45 0-1A	12.50
Q10520	MU45 0-1A	12.50
Q10525	MU45 0-20V	12.50
Q10530	MU52E 0-1A	14.50
Q10533	MU52E 0-5A	14.50
Q10535	MU45 VU PMetre	14.95
Q10538	MU65 0-50uA	16.95
Q10540	MU65 0-1mA	16.95
Q10550	MU65 0-100uA	16.95
Q10560	MU65 0-20V	16.95

CERAMICS 50V

In handy packets of 100!

Description	Price
1pF - 2.2nF	$3.50
3.3nF - 10nF	$4.50
22nF - 47nF	$4.95
100nF	$9.95
220nF	$13.95
330nF	$15.95

CRYSTALS SPECIALS

Prime Spec's. We just have too many in stock!

Description	Cat.No.	1-9	10+
1MHz	Y11000	$7.50	$6.50
1.8432MHz	Y11003	$7.50	$6.50
4MHz	Y11020	$2.50	$2.00
4.194304MHz	Y11022	$2.50	$2.00
4.433618MHz	Y11023	$2.50	$2.00
4.75MHz	Y11025	$2.50	$2.00
4.915200MHz	Y11026	$2.50	$2.00
5MHz	Y11030	$2.50	$2.00
6MHz	Y11040	$2.50	$2.00
6.144MHz	Y11042	$2.50	$2.00
6.670MHz	Y11045	$2.50	$2.00
8MHz	Y11050	$2.50	$2.00
8.867238MHz	Y11055	$2.50	$2.00
10MHz	Y11060	$2.50	$2.00
12MHz	Y11070	$2.50	$2.00
14.31818MHz	Y11072	$2.50	$2.00
15MHz	Y11075	$2.50	$2.00
18MHz	Y11082	$2.50	$2.00
18.432MHz	Y11085	$2.50	$2.00
20MHz	Y11090	$2.50	$2.00

TDK LINE FILTERS

240 V 3A
Cat. **$12.50**

½ PRICE COMPUTER TRANSFORMERS

"I can't remember the exact specs for these, however these are close"
- Rod.

X1106: 240V-9V at 10A. 2 x 12V at 1A
WAS $59.50, NOW $29
X1076: 240V-9V at 15A. 2 x 12V at 3A
WAS $49.50, NOW $24
- Limited stock, so be quick!

6BA NUTS & BOLTS

Cat. No.	Description	Price
H11060	6BA x 12mm Pkt 20	$0.95
H11061	6BA x 12mm Pkt 100	$2.95
H11062	6BA x 12mm Pkt 500	$8.95
H11080	6BA Pkt 20	$1.00
H11081	6BA Pkt 100	$3.95
H11082	6BA Pkt 500	$14.50

HIGH EFFICIENCY RADIAL FIN HEATSINK

Black anodised with a thick base plate, this radial fin heatsink can dissipate large amounts of heat for maximum efficiency. Designed by Rod Irving.

105x30mm Cat. H10520	$ 3.50
105x75mm Cat. H10525	$ 3.50
105x100mm Cat. H10529	$ 4.90
105x140mm Cat. H10534	$ 6.50
105x150mm Cat. H10535	$ 6.75
105x170mm Cat. H10538	$ 7.95
105x195mm Cat. H10542	$ 9.90
105x200mm Cat. H10543	$ 9.90
105x225mm Cat. H10546	$10.50
105x300mm Cat. H10549	$12.00
105x600mm Cat. H10560	$24.95

AA NICADS (ROCKET BRAND)

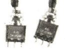
1-9	10+	100+
$1.75	$1.65	$1.40

U.V. TUBES

Fits into standard 15W flouro holder. Suitable for Scotchcal, Eprom erasing etc. As used in ETI Eprom Erasing Kit.
WARNING: Do not look directly into UV Tubes.
Cat. H28600 **$24.95**
*If ordering by mail please include an extra $2 for "special" packing.

ECONOMY ROTARY SWITCHES

Cat. No.	Description		Price
S13021	1 pol 2-12 pos.	$1.95	$0.95
S13022	2 pol 2-6 pos.	$1.95	$0.95
S13033	4 pol 2-3 pos.	$1.95	$0.95
S13035	3 pol 2-4 pos.	$1.95	$0.95



SPRING RETURN TOGGLE SWITCHES

		1-9	10+
S.P.D.T.	Cat.S11012	$2.25	$1.95
D.P.D.T.	Cat.S11022	$2.50	$2.25

TOGGLE SWITCHES

Cat.No.	Description	Price
S11009	SPST mini	$1.20
S11010	SPDT econ mini	$1.75
S11020	DPDT econ mini	$1.95
S11025	C/Off econ mini	$2.25
S11030	DPDT C/Off econ	$2.50
S11034	4PDT mini	$6.95
S11036	SPST std 125V 3A	$1.30

DIP SWITCHES

Cat. No.	Description		Price
S13402	2 Way	~~$1.50~~	$0.75
S13404	4 Way	~~$1.70~~	$0.85
S13405	5 Way	~~$1.90~~	$0.95
S13406	6 Way	~~$2.30~~	$1.15
S13407	7 Way	~~$2.40~~	$1.20
S13408	8 Way	~~$2.50~~	$1.25
S13410	10 Way	~~$3.00~~	$1.50

CABLE TIES (100mm)

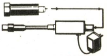
Cat. H11400 25 Pack	$1.50
Cat. H11401 100 Pack	$3.95
Cat. H11405 1000 Pack	$29.95

QUALITY MOMENTARY (RED BODY)

SPDT Cat. S11050
$1.50 **$1.40**

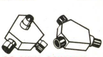
TV INTERFERENCE FILTER

Cuts CB/Ham signals interference.
Cat. L11048 **$5.95**



10dB IN-LINE COAXIAL AMPLIFIER

Reduces loss from splitters and long cable runs. Suitable for use with antennas, coaxial feed lines and VCR's. A/C adaptor included.
SPECIFICATIONS:
Frequency Range: 5-900MHz
Gain: 10dB
Power Requirements: 12V A/C Adaptor (included)
Input Impedance: 75 ohm
Output Impedance: 75 ohm
Cat. L15043 **$44.95**



CO-AXIAL SOCKETS LOW LOSS SPLITTER

Gives 2 standard co-axial outlets from one input.

Cat. L11036 (left)	$4.95
Cat. L11037 (right)	$4.95

4 WAY DIRECTIONAL JOYSTICK

Cat. X15635 **$29.95**

rie

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This is for basic postage only. Comet Road freight, bulky and fragile items will be charged at different rates.

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Registered Post for orders over $200 included "free"!

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MasterCard VISA

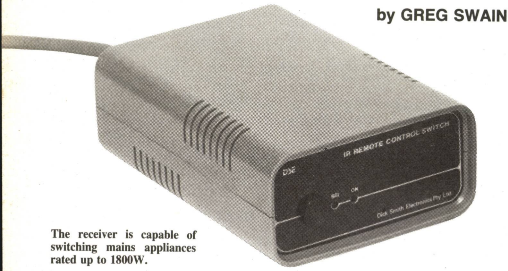
Errors and Omissions Excepted.

Don't get up. Press the button on this

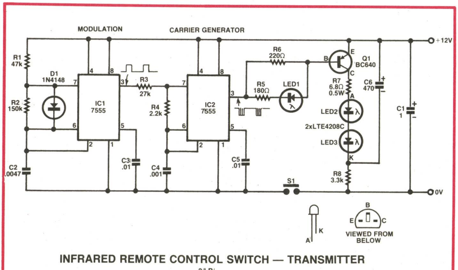
Infrared remote control switch

Want to switch your TV set on or off from the comfort of your lounge chair? This infrared remote control unit can switch any appliance at the touch of a button.

by GREG SWAIN



The receiver is capable of switching mains appliances rated up to 1800W.



INFRARED REMOTE CONTROL SWITCH — TRANSMITTER

2/LR/-

The transmitter circuit uses two TLC555 timers to generate a modulated carrier signal.

There are many situations where it would be convenient to switch a mains-appliance on or off without actually having to walk over to the mains outlet.

With this project, you can turn the TV set off after the late night movie without getting out of bed, control a table lamp from your lounge chair, or switch an outside light on when you arrive home late at night.

Other possible uses include switching a radio on or off, operating motorised curtains, or controlling an electric jug. Press the transmitter button once and the appliance turns on. Press it again and the appliance turns off. What could be neater?

The project can also be used as an ad-killer for TV. Normally, it uses a relay to switch power to a mains output socket. However, the wiring can easily be modified so that the relay contacts switch a loudspeaker in and out of circuit.

Presentation

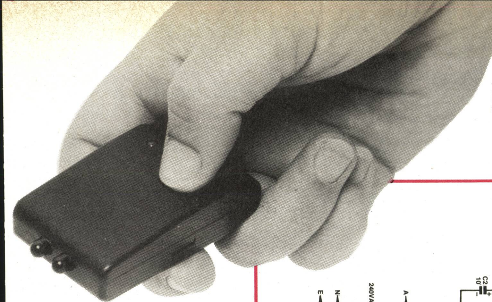
The Infrared Remote Control Switch comes in two parts: a small handheld infrared transmitter, and a companion receiver.

The transmitter is truly pocket size and is housed in a neat little plastic case with an integral clip on the back and a pushbutton on the top. It can be carried around in your pocket or clipped to your shirt. The receiver is also housed in a plastic case and is fitted with a 3-pin mains socket on the rear panel.

Overall dimensions are 36 x 60 x 20mm (W x D x H) for the transmitter, and 95 x 135 x 48mm (W x D x H) for the receiver.

How it works

In use, the receiver is simply plugged into the mains and the appliance to be controlled plugged into the socket on the rear panel. Appliances with ratings



Left: the compact handheld transmitter unit.

Below: the receiver circuit consists of a preamplifier/detector (IC1), a phase lock loop tone decoder (IC4), and an output latch circuit (IC3b).

up to 1800W can be used, the limit being set by the ratings of the relay contacts and associated wiring.

When the transmitter button is pressed, the transmitter sends out a burst of modulated infrared light. At the same time, a small red LED adjacent to the button lights to indicate that a signal is being transmitted.

The receiver unit decodes the transmitted signal and switches the internal relay to control the mains outlet. Two front-panel LEDs indicate the receiver status. The first, labelled 'SIG' (short for signal), comes on whenever a signal is received from the transmitter. The second, labelled 'ON', turns on when the relay turns on.

Provided the line of sight between the transmitter and receiver is clear, a control distance of about 12 metres can be expected. This range is dependent on several factors. Electrical noise, strong light or strong RF signals may affect the sensitive high gain front-end of the receiver but, even under adverse conditions, the system will still operate over the full length of an average-size room.

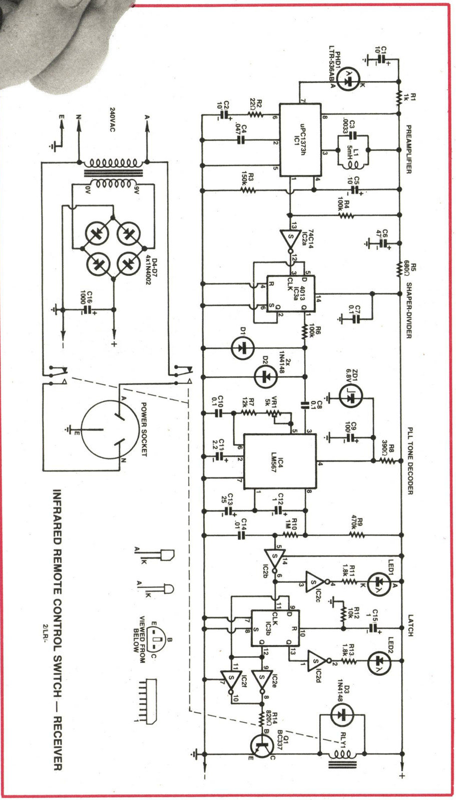
Note that the transmitter is designed to deliver maximum output when the button is first pressed. After that, the transmitter output drops to a much lower level. Once the button has been pressed, maximum output can only be regained by releasing the button for approximately 10 seconds.

This feature is designed to increase battery life.

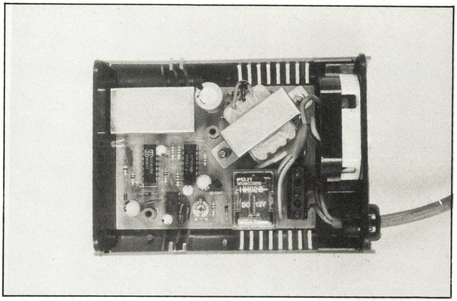
Circuit details

Let's now take a look at the circuit. We'll begin with the transmitter.

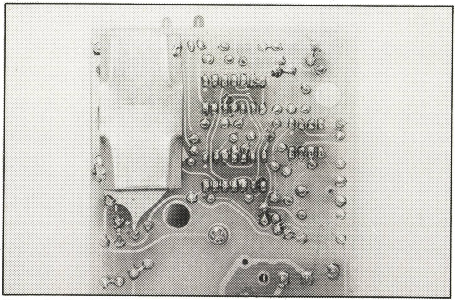
At the heart of the transmitter are two TLC555 timer ICs. These generate a 35kHz carrier signal which is pulse modulated at 1.5kHz. This is done so that the receiver can selectively decode the signal from the transmitter and re-



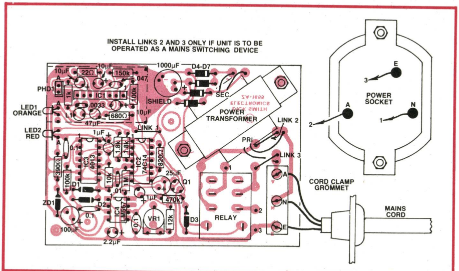
INFRARED REMOTE CONTROL SWITCH — RECEIVER



Above: view inside the receiver. Note metal shield over preamplifier stage at top left.



Above: view showing how the rectangular shield is mounted on the underside of the PCB.



INSTALL LINKS 2 AND 3 ONLY IF UNIT IS TO BE OPERATED AS A MAINS SWITCHING DEVICE

Parts layout and wiring diagram for the receiver. See note regarding links 2 and 3.

Infrared switch

ject signals from other sources.

The TLC555 is essentially a CMOS version of the familiar 555 timer. IC1 is wired in astable mode and generates the 1.5kHz modulating frequency, as set by R1, R2, C2 and D1.

Note that D1 is forward biased during the charge cycle and reverse biased during the discharge cycle. It thus modifies the output frequency and gives a 1:3 output duty cycle, as determined by the ratio of the two timing resistors.

The output from IC1 appears at pin 3 and consists of a pulse train that is alternately high for 160µs and low for 500µs. This pulse train is used to control IC2 which is the carrier generator.

R3, R4 and C4 set the output frequency of IC2. When pin 3 of IC1 is high, IC2 is enabled and generates the 35kHz carrier signal. Conversely, when the output of IC1 is low, IC2 is disabled and its output remains high.

The resultant pulse modulated carrier signal appears at pin 3 and drives transistor output stage Q1 and two infrared LEDs (LED 2 and LED 3). At the same time, LED 1 is rapidly pulsed on and off by the carrier signal and thus appears to be continuously lit.

Resistor R7 limits the peak current through the two infrared LEDs to about 1A. While this level of current may seem excessive, the LEDs are in fact operated well within their ratings due to the low duty cycle of the carrier waveform (approx 1:15).

Power for the circuit is derived from a small 12V lighter battery and is switched to the circuit via S1 (which serves as the transmit switch). Because the battery is quite small, some form of energy management is necessary otherwise it would soon go flat. This is where C6 and R8 come in.

Initially, with S1 off, C6 charges via R8 to the full potential of the battery. Thus, when S1 is pressed, the full battery voltage is applied by C6 to Q1 and the infrared LED output stage. This scheme ensures maximum initial output from the infrared LEDs and increases the maximum range.

C6 subsequently quickly discharges via the forward-biased output stage. Resistor R8 then comes into play and limits the current through the output stage to about 2mA. The transmitter will now still operate, but over a much reduced range.

Maximum range can only be achieved again by releasing S1 for about 10s, as noted previously. This time is set by the time constant of R8 and C6, and the internal resistance of the battery.

If it were not for the above scheme, the range would either be severely limited or the battery would quickly go flat. As it stands, the battery should last for many months before requiring replacement.

Receiver

The receiver circuit can be broken up into three broad sections: an input preamplifier/detector, a PLL (phase lock loop) tone decoder, and an output latch/relay driver circuit.

The incoming infrared light is picked up by an LTR-536AB photodiode (PHD1) and applied to pin 7 of IC1. Made by NEC, this IC is a dedicated high-gain preamplifier/detector designed specifically for use in infrared remote control systems. It provides bias for the external photodiode and contains an amplifier stage, a limiter, a peak detector, and an output waveshaping buffer.

The internal amplifier stage is tuned by L1 and C3. These set the centre frequency to 35kHz to match the carrier frequency generated by the transmitter. The following detector stage extracts the 1.5kHz modulation signal from the carrier and passes it via the waveshaping buffer to the output (pin 1).

The resultant 1.5kHz signal is subsequently buffered by Schmitt trigger IC2a and applied to the clock input of IC3a, a 4013 D-type flipflop. IC3a divides by two and converts the input waveform to a 50% duty cycle.

The 750Hz output from IC3a is extracted from pin 1, clipped by diodes D1 and D2 and coupled via C8 to pin 3 of IC4, and the LM567 tone decoder IC. Inside the tone decoder is a phase lock loop. VR1, R7 and C10 set the centre frequency of the PLL to 750Hz, while C11 sets the detection bandwidth.

Whenever it receives a 750Hz signal, IC4 switches its pin 8 output low. C12, in conjunction with C13, stretches the output pulse to around 1.5 seconds, while R9, R10 and C14 provide further output filtering. IC2b and IC2c buffer the low output from IC4 and drive LED 1 (the signal received LED).

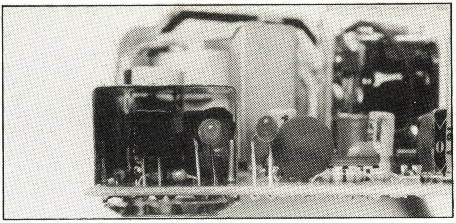
Latch circuit

IC3b forms the output latch circuit. Each time pin 6 of IC2b switches high, IC3b toggles, its Q and Q-bar outputs going alternatively high and low. The Q-bar output drives output transistor Q1 via parallel Schmitt inverter stages IC2e and IC2f.

When Q-bar is low, Q1 turns on and activates the output relay. At the same time, the Q output drives LED 2 via IC2d to indicate the "ON" condition. When the next pulse is received from IC2b, Q-bar goes high, Q goes low, and Q1, the relay and LED 2 switch off.

C15 and R12 provide power-on reset for IC3b. This sets Q low and Q-bar high and ensures that the relay remains off when the receiver is first powered up.

Power for the circuit is derived from a mains transformer with a 9V secondary. This drives a bridge rectifier (D4-D7) and a 1000μF filter capacitor (C16) to provide a nominal 12V rail (depending on the load). R1/C1 and R5/C6 decouple the supply rail to the photodiode and IC1, while ZD1 provides a regulated 6.8V supply for the LM567 tone decoder.



This view shows how the metal shields, photodiode and LEDs are mounted on the receiver PCB.

RECEIVER PARTS LIST

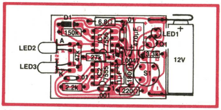
1 plastic case assembly with pre-punched panels and screened lettering
1 printed circuit board, code ZA-1655, 100 x 70mm
1 3-pin 10A mains socket (HPM55)
1 9V 150mA mains transformer
1 3-core mains cord with moulded plug
1 1 PC-mounting mains terminal block
1 12V DPDT relay, 240V 10A contacts
1 5mH RF choke
2 pre-made tinplate shields
4 PC stakes
3 75mm lengths of 24/0.2mm hookup wire (brown, blue and green)
2 3 x 9mm Philips-head screws
2 3 x 19mm Philips-head screws
4 3mm hex nuts
4 3mm washers

Semiconductors
1 uPC1373H preamplifier
1 74C14 hex Schmitt inverter
1 4013 dual D-type flipflop
1 LM567 PLL tone decoder
1 BC337 NPN transistor
4 1N4002 diodes
3 1N4148 diodes
1 6.8V 400mW zener diode
1 LTR-536AB (BPW50) photodiode
1 3mm red LED
1 3mm orange LED

Capacitors
1 1000μF 16VW PC-mounting electrolytic
1 100μF 25VW PC-mounting electrolytic
1 47μF 35VW PC-mounting electrolytic
1 25μF 25VW PC-mounting electrolytic
3 10μF 25VW PC-mounting electrolytics
1 2.2μF 25VW PC-mounting electrolytic
2 1μF 50VW PC-mounting electrolytics
3 0.1μF ceramics
1 .047μF ceramic
1 .01μF ceramic
1 .003μF ceramic

Resistors (0.25W, 5%)
1 x 1MΩ, 1 x 470kΩ, 1 x 150kΩ, 2 x 100kΩ, 1 x 12kΩ, 1 x 10kΩ, 2 x 1.8kΩ, 1 x 1kΩ, 1 x 820Ω, 1 x 680Ω, 1 x 390Ω, 1 x 22Ω, 1 x 5kΩ miniature horizontal trimpot.

Infrared switch



Above: parts layout for transmitter PCB.

Construction

Construction is straightforward, with the parts accommodated on two small printed circuit boards (PCBs). The transmitter board is coded ZA-1657 and measures 32 x 45mm, while the receiver board is coded ZA-1655 and measures 100 x 70mm.

Begin construction by installing the parts on the transmitter PCB. No special procedure need be followed, but note carefully the orientation of the ICs, transistor, LEDs and electrolytic capacitors when they are being installed.

Capacitors C1 and C6 should be installed so that they lie flat against the PCB, as shown in the layout diagram. Bend their leads as appropriate before soldering them in position. Note that the flat side of the switch body faces towards R8.

The two infrared LEDs (grey) are mounted with their leads bent at right angles, 4mm from the LED bodies. The cathode (K) lead is adjacent to the flat edge on the side of each LED. The indicator LED (LED 1) should be left off the board for the time being.

The case must now be modified to accept the two infrared LEDs. To do this, position the PCB in the bottom half of the case and mark the two LED centre points. A rat-tail file can then be used to file two semi-circles in the front lip of the case. These semi-circles should each be 5mm in diameter and 2.5mm deep.

This done, the two halves of the case can be clipped together and matching semi-circles filed in the top half. Check your work regularly as you progress by introducing the two LEDs to the holes (you can do this from outside the case).

Don't make the holes too big — the LEDs should just be a neat fit.

Finally, the red indicator LED (LED 1) can be soldered into circuit. To do this, install the LED on the PCB, position the board in the top half of the case, and adjust the lead length so that the top of the LED lines up with the top of its access hole. The leads can then be soldered and trimmed.

Note that the holes for the pushbutton switch and the indicator LED are part of the original case moulding.

Construction of the transmitter can now be completed by fitting the battery (watch the polarity) and clipping the two halves of the case together.

Receiver assembly

Because IC1 (uPC1373H) in the transmitter is a high-gain stage, it must be shielded from adjacent circuit components. This takes the form of a simple U-shaped shield mounted on top of the PCB, and a rectangular shield plate mounted on the underside of the PCB.

The shield components are cut from 0.3mm-thick tinplate and are supplied ready-made with the kit. They are supported on the board by means of four PC stakes.

Begin assembly of the receiver PCB by fitting the PC stakes to the shield corner positions. After that, the various components can be installed, but leave C16 and the transformer off the board for the time being.

As before, take care with the orientation of the semiconductors and electrolytic capacitors. Pin 1 of IC1 is indicated by a bevelled edge at one end of the IC. The IC should be installed with this adjacent to R4 (100kΩ).

Note that there are three wire links on the PCB. Link 2 and Link 3 should be installed only if the unit is to be operated as a mains switching device. These links should be sleeved with spaghetti insulation.

The LTR-536AB photodiode must be stood off the PCB by 4mm. Make sure that it is correctly oriented — the cathode lead is indicated by the bevelled edge on the top of the case.

The two indicator LEDs are installed with their leads bent at right angles about 4mm from their bodies. These should be installed at full lead length. Later on, they will have to be manipulated to fit through matching holes in the front panel.

Take care when installing the two LEDs. LED 1 should be installed with its anode adjacent to PHD1, while LED 2 has its anode adjacent to C7 (0.1µF).

Once all the components have been fitted, the metal shields can be installed. These are simply solder tacked to the four PC stakes previously fitted to the board. After that, C16, the mains transformer, and the relay can all be installed.

Trim the leads of the transformer to a suitable length before soldering them to the PCB. The centre tap of the secondary is not used — it can be cut short and covered with heatshrink tubing or insulation tape.

The transformer is secured to the PCB using machine screws and nuts.

TRANSMITTER PARTS LIST

1 plastic case assembly
1 printed circuit board, code ZA-1657, 32 x 45mm
1 pushbutton switch (S-1200 type)
1 positive battery contact
1 negative battery contact
1 mini 12V battery

Semiconductors

2 TLC555 or 7555 CMOS timers
1 BC640 PNP transistor
1 1N4148 diode
1 3mm red LED
2 LTE-4208C (LD271) infrared LEDs

Capacitors

1 470µF 16W electrolytic
1 1µF 50W electrolytic
2 .01µF ceramics
1 .0047µF ceramic
1 .001µF ceramic

Resistors (0.25W, 5%)

1 x 150kΩ, 1 x 47kΩ, 1 x 27kΩ, 1 x 3.3kΩ, 1 x 2.2kΩ, 1 x 220Ω, 1 x 170Ω, 1 x 6.8Ω 1/2W

Where to buy the kit

This project was developed at the Research and Development Department at Dick Smith Electronics Pty Ltd. It can be purchased as a kit of parts, either by mail order or from your nearest Dick Smith Electronics Store.

The kit comes complete and includes fibreglass PCBs, plastic cases, pre-punched panels with screened lettering, and a construction manual. The cost is $69 plus postage and packing charges where applicable.

Mail orders should be sent to: Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde, NSW 2113. Phone (02) 888 2105.

Note: PC artworks are copyright © Dick Smith Electronics Pty Ltd.

Final assembly

With the PCB assembly now completed, attention can be turned to the plastic case. This is supplied with pre-punched front and rear panels.

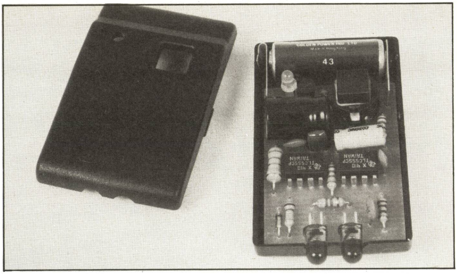
Fit the mains socket to the rear panel and wire it to the PCB using short lengths of mains-rated hookup wire. Take care with the mains wiring — the three socket terminals are clearly labelled A, N and E (active, neutral and earth).

The mains cord enters through a cord-grip grommet on the rear panel and its leads terminate in the 3-way terminal block installed on the PCB.

Next, the red bezel can be fitted to the front panel. Cut off the rear tips of the shoulders and position them so that they meet the vertical edges of the photodiode. The two indicator LEDs can then be pushed through the front panel holes and the completed assembly installed in the case.

The PCB is designed to fit over the integral mounting bosses in one of the case halves. Note that the front half of the board will be obstructed by one of two 3mm posts. This post should be removed using a pair of sidecutters.

The top half of the case should be left off until after the adjustment procedure.


Above: the transmitter PCB fits neatly into the small plastic case.

Adjustment

This procedure simply involves adjusting VR1 to set the centre frequency of the LM567 tone decoder.

To do this, set VR1 to mid-position, plug the receiver into the mains, and press the transmitter button. Check that the relay operates and that LED 1 lights for a brief period. If not, adjust VR1 until a response is obtained (keep the transmitter button pressed during this procedure).

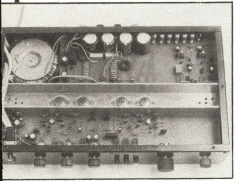
VR1 can now be adjusted for maximum range. Progressively increase the distance between the transmitter and receiver (you'll need another person to help you) and adjust VR1 each time until the relay operates. Continue this process until the maximum range is obtained.

Finally, remove the centre-most boss of the top half of the case and clip the two halves of the case together. You can now plug a mains appliance into the receiver and switch it on and off to your heart's content.

Next month in

Electronics Australia

Playmaster Sixty Sixty Stereo Amplifier



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Stereo Compressor for CD Players

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UHF Antenna for Channel 28

If you intend building the UHF to VHF Converter described on page 24, you'll need an antenna to go with it. This antenna has been specially designed for Channel 28 and can be built for less than $25.

Note: Although these articles have been prepared for publication, circumstances may change the final content.

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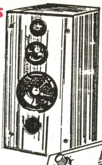

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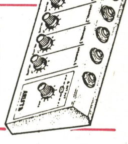

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SPECIAL OFFER - We welcome technical scrutiny of this magnificent CD player. To prove this, we can supply a detailed 40 page technical service manual on the ADC CD-100X. This manual (one of the best we've seen out of Japan) covers theory of player operation, circuit operations, test procedures, test print and waveform illustrations, block diagrams, IC description and schematic diagrams and much, much more! If you wish to review this manual before you buy send $10 (inc. P&P) for a copy. After reading this manual we are certain you will buy. (When you buy the CD-100X we will take $10 off the purchase).

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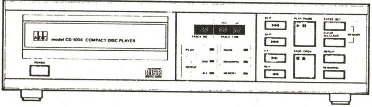
Frequency Response:	5 - 20kHz ±0.5dB
T.H.D.:	0.004%
Dynamic Range:	95dB
Channel Separation:	90dB @ 1kHz
Optical Pickup:	3 beam laser
D/A Conversion:	16 bit linear
Filter:	Seventh order passive filter
Error Correction:	CIRC dual error system



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FEATURES

● Operating range up to 750 feet (250m) ● Security code system with 16,384 combinations ● Last number re-dial ● Call function at base unit to alert handset ● Power on/off switch and standby/talk switch on handset ● Reset button for hanging up and recalling dialling tone ● Pulse dialling with audible tone feedback at the touch of a key ● LED indicator on handset for low battery indication ● Built-in overcharge protection for handset unit ● Handset switched automatically from "Talk" to "Standby" mode when placed on base unit ● Hearing aid compatible.
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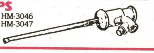

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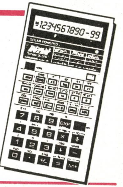

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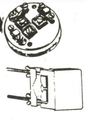

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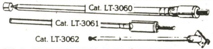

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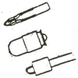

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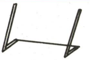

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The Serviceman

On being "phased" by a turntable

As I have mentioned before in these notes, one's first encounter with a completely unfamiliar piece of equipment can be somewhat traumatic. Even a strange model TV set can prove a setback but when a completely different piece of equipment turns up, and boasting a rather weird fault to boot, one is really starting from behind scratch.

In this case the job was a direct drive, crystal controlled turntable with the customer's complaint that it was running fast. From the way he spoke I imagined that the error was only minor and that it might require nothing more than a tweak of an appropriate adjustment.

Had I thought that it was likely to be much more serious than that, I might well have had reservations about tackling it in the first place. In fact, I wasn't all that enthusiastic anyway, because the truth is I had never had the slightest experience with such a device before and had only a vague idea of their design philosophy.

On the other hand I don't like knocking customers back, and one has to face up to new devices sooner or later. In addition, the customer was leaving town for several months so that I could tackle it at my leisure. And so I accepted the job.

It was a Marantz model TT-6000 and my first thought was whether I could get hold of a circuit or, better still, some kind of manual. I rang the local agents and they proved to be most helpful. A service manual was available, for a nominal fee of a few dollars, and they would be happy to post it to me. I promptly despatched the necessary order and cheque.

While waiting for the manual to arrive I decided to turn the unit on and get some idea of how far out it was. I slipped a strobe card on the turntable, moved it under the bench light, and set it running. And that was the first shock, because the customer's description must have been the understatement of the year.

According to the strobe card the speed went through 33rpm almost immediately, then through 66, 99 and so on until it finally settled down, as nearly as I could determine from the vague pattern on the strobe card, somewhere near 165rpm. So much for my hopes for a minor error needing a tweak with a screwdriver. I put it aside to await the manual.

In the meantime I quizzed a few colleagues and technical acquaintances regarding the circuit philosophy of such devices in general and, hopefully, about the Marantz TT-6000 in particular. I didn't score much specific information but I was able to get some idea of the broad concept of these devices.

Direct drive

As the term "direct drive" implies, these devices have the turntable mounted directly on the motor shaft. The motor is usually described as a "brushless DC type"; a description which I have always regarded as being, at best, a contradiction in terms. In greater detail, they are a DC motor in which the conventional brushes and commutator have been replaced with some form of electric commutation.

Electronic control starts with a suitable crystal, typically running at several megahertz, followed by a divider network which delivers a suitable waveform at a few hertz. There is also a sensing mechanism — usually a coil — which senses the speed of the turntable, and generates an appropriate AC signal.

This signal is compared with that from the crystal divider, and the two should agree. If they don't, suitable corrective voltages are generated which will alter the turntable's speed. And that was about as much as I could glean. Circuit details, methods of comparison, methods of correction, etc, were all quite vague, possibly because they vary so much from make to make.

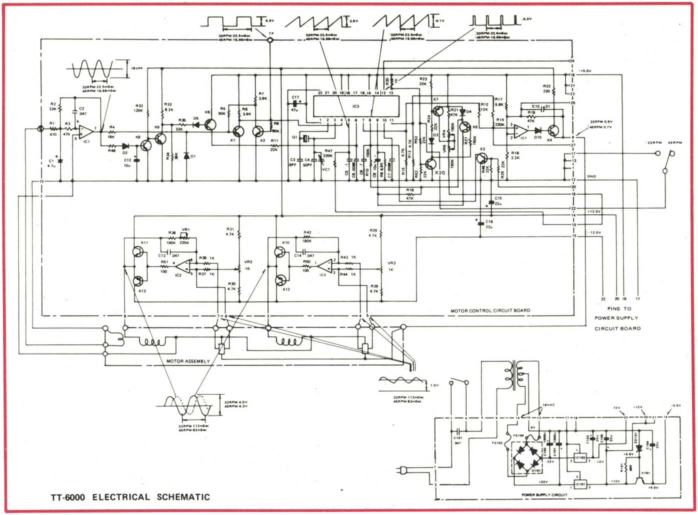
In due course the manual came to hand. In one sense it was very good in that it provided a wealth of service information. It included a circuit diagram plus waveforms, voltages, and printed board patterns, plus adjustment instructions for speed, wow and flutter, tone arm mechanical functions, and so on.

What it didn't do was provide the slightest hint as to how the circuit worked. Significantly the introduction stated ". . . data in this manual are intended for use by experienced service technicians, knowledgeable in turntable designs and service." Unfortunately, I was not ". . . knowledgeable in turntable design and service." I was just a beginner.

Frequency checks

Nevertheless, I decided to press on, on the basis of the data available, and hope for the best. It seemed to me that the first thing to be checked was whether the crystal oscillator was functioning and at the right frequency. The crystal operates in conjunction with IC3, a 22-pin device designated GCMK-363Y on the printed board pattern, but which was an SM6415A in the unit.

The crystal, marked as 9.331200MHz, is connected between pins 2 and 3, and is fitted with a small trimmer capacitor for exact frequency adjustment. According to the manual, the crystal frequency should be checked at pin 13, which appears to be the output from the divider network. This should be 44.44Hz



TT-6000 ELECTRICAL SCHEMATIC

(22.5ms) when set for 33rpm, and 60Hz (16.66ms) for 45rpm.

I stoked up the CRO and checked pin 13. The waveform and frequency appeared to be correct, at least to a first approximation. I didn't bother setting up the frequency counter since, if there was any error, it was minor and nothing like the gross error in turntable speed.

There are four other waveforms around this part of the circuit, but attempts to observe three of these made little sense. Not only were the frequencies nothing like those shown on the circuit, but they were quite unstable. Looking at the circuit again and recalling what I had already learned from colleagues, I attempted to analyse this part of it and determine its various functions.

I located a winding on the circuit which I deduced was the sensing coil monitoring the speed of the turntable. This was fed into an op amp (part of IC1), the output of which (pin 7) was tagged with a waveform showing a sinewave at 44.44Hz and some 18Vpp amplitude. From here the signal went through a network of transistors and diodes, appearing next at a test point showing a square wave at 44.44Hz and 5Vpp amplitude.

This signal was fed into pin 4 of IC3 and appeared again at pin 5 as a triangular waveform, same frequency, at 2.8Vpp. Finally there was another triangular waveform, shown at pin 8, same frequency, but at 4.1Vpp. This latter waveform was the only one, apart from that at pin 13, which made sense. It was more or less as it should have been, and was rock steady. I assumed that it was derived from the crystal.

The other three waveforms were obviously variations of the signal from the sensing coil. In fact, when the turntable was stopped they vanished and, if it was turned by hand, they re-appeared at whatever odd frequency the speed of the turntable dictated. Small wonder that they made little sense on the CRO, with the turntable being driven at about five times its normal speed.

But, as I understand it, this signal was supposed to be compared with the crystal frequency, somewhere inside the IC, and the necessary correction process — the exact nature of which wasn't clear — brought into play to maintain the correct speed. So was the IC at fault? It seemed a reasonable possibility and I decided to put the CRO aside and make some voltage measurement around the IC. Fortunately, the manual is most comprehensive in this regard, giving the voltages for all 22 pins.

The IC is fed from a regulated 5V rail and, while the value was spot on, none of the other voltages around the IC made any sense at all. On this basis I concluded that the IC was the likely culprit. It didn't appear to be a stock item, and I certainly had nothing like it on hand, but a phone call confirmed that it was readily available from the Marantz agent.

So a new IC was ordered and duly arrived a couple of days later. I plugged in the sucker iron and set about removing the old IC, a somewhat delicate job since the pins are fairly close together and some of the PC tracks rather fine. But it was successfully completed, the new IC fitted, and the board carefully checked for any solder faults. Satisfied that all was well, I fitted the board back into the circuit.

Then I switched on and waited, fully expecting it to run at normal speed. I suppose the reader is way ahead of me; yes, it behaved exactly as before. Which was a bit of a blow, to put it mildly. Considering how little I knew about the device, I was temporarily at a loss to decide what to do next.

There is another IC in this part of the circuit, IC1, which I have already mentioned briefly. It appears to be a fairly standard dual op amp. One op amp handles the sensing coil signal already described, the other takes an output from IC3, which appears to be the motor drive signal. This appears further down the line as an approximate sine wave at 8.85Hz (113ms) for 33rpm, or 12Hz (83ms) for 45rpm. It is eventually fed to another IC (IC2) and the power transistors which drive the motor.

I had a similar IC on hand and it wasn't a big job to substitute it. Again I drew a blank.

Next I went over the board with the multimeter and checked everything I could in situ, including the transistors. Still no clues. Since I couldn't completely trust these in-situ tests it looked as though the next step would be to remove and replace any suspect components, particularly the transistors.

Supply rails

Then I had another idea. As far as I could see from the circuit, the main chip, IC3, was fed entirely from the 5V regulated rail already mentioned, which was spot on. But the power supply provided two other rails, −12V and a +12V, which as far as I could see were associated with the motor drive circuitry. I hadn't checked these because they seemed to be remote from the problem area, but now I wasn't so sure.

The power supply is a fairly conventional arrangement for what it has to do. It uses a regular power transformer delivering 16V AC each side of a centre tap, the full 32V being fed to a bridge rectifier. The positive and negative terminals of the bridge each develop 22V — positive and negative respectively with respect to the centre tap.

Each of these is fed to a 3-terminal 12V regulator, a positive type (IC101) for the positive rail and a negative type (IC102) for the negative rail. The 5V rail is derived from the +12V rail via a second regulator made up from discrete components.

A check confirmed that the 5V rail was spot on as before. So was the +12V rail from which it was derived, but the −12V rail was a different matter — it was delivering a mere 3V. Since it was being supplied with −22V from the bridge I reasoned that we had either a faulty regulator or excessive drain which was pulling it down.

I found the 3V value somewhat puzzling. Regulators don't usually fail in such a manner; it is usually an all-or-nothing fault. On the other hand, the regulator was certainly not overheating, as I would have expected for an overload condition. So, after a quick check for any other obviously faulty components, I concluded that it had to be the regulator.

It was a standard type, 7912, but I had none in stock. So one had to be procured, which was a trifle frustrating, but it eventually arrived and I lost no time in fitting it. And that was the answer. Everything dropped into place; all the voltages on IC3, all waveforms — including shape, amplitude, and frequency — came up spot on, the frequency being checked with the counter. And, of course, the turntable speed was also spot on.

But just how the faulty −12V rail caused the turntable to run fast — very fast — I have no idea. Had it run slow it would have been easier to accept. Unfortunately, until I can get my hands on some more detailed literature I can do no more than accept the evidence before me.

In any case the final solution was something of an anti-climax for me. While I was happy enough to have solved the problem I was annoyed at being caught out by what was really a very simple fault. The truth was that I had been unable to see the wood for the trees; I had assumed that such a complex fault just had to be in the most complex part of the circuit.

Granted, the symptoms were misleading, but had I bothered to check all three supply rails first, instead of the one which seemed to be important, I would have saved myself a lot of time and effort.

Hopefully, I have learned something from the exercise, and not only in the technical sense.

Mis-focussed Rank

To finish off, here is a letter from a Queensland reader, Mr C.H., who gives his address as Brisbane airport. The letter is interesting for several reasons.

TETIA Fault of the Month

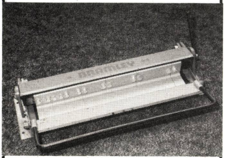
Philips KT2A

Symptom. Intermittent shutdown. Often when changing channels but only rarely when set is bumped.

Cure. Broken track from pin 11 on line output transformer. Under 5.6kΩ 5 watt resistor. This resistor is mounted hard against the board on the copper side and it chars the board under the track.

This information is supplied by courtesy of the Tasmanian branch of The Electronic Technicians' Institute of Australia. Contributions should be sent to J. Lawler, 16 Adina St, Geilston Bay 7015.

BRAMLEY



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The main one is that the symptoms and fault are virtually identical with those described in my March notes, the only difference being that the sets, while of the same make and vintage (early Rank), used different size tubes.

A further similarity is that both of us balked at the idea of having to replace an entire assembly, at considerable cost, to correct one faulty component. But there the similarity ends because, while we both "beat the system", the approaches were quite different.

Finally, as you read the letter, note that it was written long before my March story appeared. Here it is:

You my be interested in this story as a novel solution to a straightforward but potentially expensive fault.

I am not a professional serviceman, but employed in the electronics field of a large government department. Occasionally, if caught in a weak moment, I agree to repair a piece of domestic equipment for a friend or relative.

In this case the equipment was a rather elderly Rank Arena TV receiver model 2601. The fault was gross mis-focussing of the picture with an audible hiss indicative of EHT leakage. It was readily diagnosed as a failure of R571, a 132MΩ resistor which forms part of a network to provide voltage for the picture tube focussing electrode.

This resistor is approximately 150mm long and 12mm in diameter. It is attached to the chassis by clamps and connected to the trippler by EHT cable. The case was cracked and EHT could be seen tracking to chassis from the crack. The solution seemed simple enough — just replace the resistor.

Oh yeah!

The manufacturers advised replacement resistors not available. The resistor network is now included as part of the trigger assembly — at a cost of $86! This cost could not be justified for such an old set, particularly as I could not be certain that this was the only fault.

How to obtain a 132MΩ resistor? A quick search of bench drawers produced a few 10MΩ resistors — a value so high it never gets used these days and seems to wind up thrown in a drawer. A scrounge around colleagues produced a few more and an idea was born.

Thirteen of these resistors were wired up in a series string. They were mounted inside a length of 12.5mm conduit and the whole assembly potted in epoxy. It was mounted in a set by the original clamps and wired up.

The set was switched on with some trepidation but there was no sign of any flashover. A slight touch-up of the focus control, VR503, and the set produced a first class picture. After test running for a day or two, just to be sure, it was returned to a very happy owner. It should continue to give good service for a few more years yet.

Well, C.H., I must confess I read your letter with mixed feelings. My first reaction was to award full marks for ingenuity. A story like this makes one realise that Australians, as a race, haven't lost their pioneering get-up-and-go; it's simply been transferred from fencing wire and kerosene tin technology to the electronic work bench.

But I must also admit to having some reservations about the idea. How reliable is it likely to be? I certainly wouldn't be game to try it myself, at least on a professional basis, for reasons which I am sure C.H. will understand. His case was different, being essentially a "nothing-to-lose" situation.

At a practical level, my reservation is mainly in regard to the resistor's behaviour with high voltages applied to them for long periods. It is not clear what type of resistors C.H. used but these days most general purpose carbon film or metal film resistors have a maximum voltage rating of 250V or 350V. Exceeding these ratings eventually leads to flashover and ultimate failure of the resistor.

By my calculation, each resistor in the string would have around 1500V applied to it, which amounts to between four and six times the maximum recommended value. So just how long the resistors last under these conditions, even though they may be effectively encapsulated in epoxy, is a matter for some concern.

So there are my thoughts for what they are worth. I'm not setting out to knock C.H.'s effort; on the contrary, I give him full marks. But I feel bound to sound a warning. Let's hope it isn't necessary and that C.H. can write me another letter in a couple of years and report that the set is still working.

Editor's note: the idea of a string of resistors is quite valid provided high voltage resistors are used. We suggest Philips VR37 or VR68 high voltage metal film resistors. These are manufactured with values up to 33MΩ although a value of 10MΩ would probably be easiest to obtain. The type VR37 has a DC voltage rating of 3.5kV and an rms voltage rating of 2.5kV. For type VR68, the equivalent values are 10kV and 7kV.

hi-fi junction

AN INTRODUCTION

As you may not have seen our stores or our advertising in the past, (we are new to this magazine) we thought a brief outline of our company may be of interest. Since late 1977, we have been promoting high quality sound equipment at affordable prices. This led us to the lines of product which, we believe, is the finest the market offers for the price. Eight years and 20,000+ customers later, we still have two of our original suppliers: Aiwa and N.A.D. Both have continued to provide exceptional value-for-money; Aiwa excel in their "Walkperson", "Midi-system" and Cassette Deck ranges, N.A.D. with their "uncommon" Amplifiers, Tuners, Receivers and Compact Disc players. Onkyo from Japan, is the most recent addition to our range; first supplies have just arrived in mid-February and the interesting, beautifully engineered machinery is being very well received.

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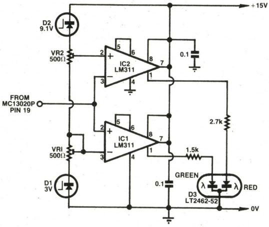
Circuit & Design Ideas

LED tuning indicator for AM Stereo Decoder



This simple tuning indicator is designed to operate with the AM Stereo Decoder described in EA, October 1984. As the original article noted, accurate tuning is necessary for reliable AM stereo reception.

Even where the associated tuner has a signal strength meter, its response may be too broad to be useful as a tuning aid. This circuit, using two LM311 voltage comparators and an LT 2462 (Dick Smith Z-4070) dual colour LED, gives an accurate visual tuning indication which is also usable on mono AM stations. The dual colour LED is used to save panel space, but may be replaced with two separate LEDs if required.

The two voltage comparators (IC1 and IC2) compare the phase detector voltage at pin 19 of the MC13020P decoder with two reference voltages derived from a voltage divider. Power for the indicator is taken from the same source as for the AM Stereo Decoder. Zener diodes D1 and D2 are selected to set the outer ends of the voltage divider potentiometers at about 3V and 6V.

In use, the LED shows red (high) or green (low) when the radio is off frequency, and is off when the radio is tuned accurately. The LED also shows red when the MC1302P VCO is unlocked between stations.

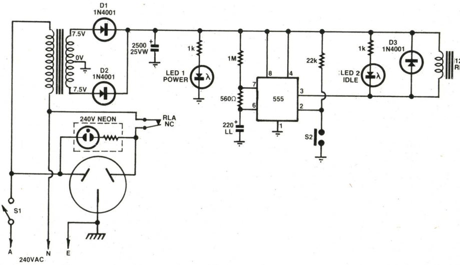
To calibrate the indicator, first carefully tune the radio to an AM stereo station, then set VR1 and VR2 so that both LEDs are just off. If a digital multimeter is available, find the range of the phase detector voltage (MC13020P pin 19) within which stereo reception occurs and set VR1 and VR2 to give voltage comparator references 25-30mV either side of the midpoint. VR2 effectively sets the width of the LED null, while VR1 sets the position of the null in relation to the desired tuning point.

The null can be varied in width to suit the tuning characteristics of the radio used. Once calibrated, reliable stereo reception can be quickly achieved by tuning to the LED null.

D. R. MacCarthy,
Hoppers Crossing, Vic.

$25

Automatic shut-off for soldering irons



This circuit is designed to switch off a soldering iron after approximately six minutes, although it could also be used to control other appliances.

A 555 timer wired as a monostable performs the timing function. When S2 is pressed (ie, a negative trigger pulse is applied to pin 2), pin 3 switches high, the relay turns off, and power is applied to the soldering iron via the normally closed contacts of the relay.

The 220µF timing capacitor on pin 6 now charges via the 1MΩ and 560Ω timing resistors. When it reaches 2/3Vcc, the output (pin 3) switches low, the relay turns on and power is disconnected from the soldering iron. At the same time, pin 7 switches low and quickly discharges the 220µF capacitor via the 560Ω resistor.

The soldering iron can now be switched on for a further six minute cycle simply by pressing S2. A 240V neon bezel across the mains socket indicates when the iron is on, while LED 2 indicates the idle condition (ie, when the soldering iron is off).

D3 protects the 555 timer from back EMF when the relay turns off.

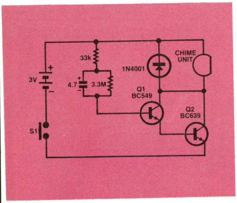
Power for the circuit is derived from a 15V centre-tapped transformer which drives a full wave rectifier (D1 and D2) and a 2500µF filter capacitor. This delivers a nominal 10.5V rail.

D. King,
Springvale, Vic.

$15

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Simple cure for doorbell pests



We all know how irritating it can be when a visitor repeatedly rings the doorbell or keeps the button depressed until the door is answered.

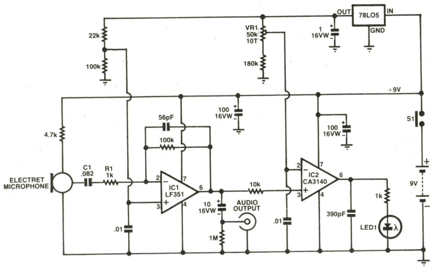
This simple circuit solves that problem by allowing only a couple of rings. The doorbell must then be released for a short period in order for the circuit to reset.

Transistors Q1 and Q2 form a Darlington pair which switches the negative supply rail to the chime unit. When the doorbell is pressed, Q1 and Q2 are on only while the 4.7μF capacitor is charging. Once the capacitor has charged, Q1 and Q2 turn off, thus switching off the chime unit.

The circuit is reset by the 3.3MΩ resistor which discharges the 4.7μF capacitor when the doorbell is released, ready for the next visitors. D1 protects Q2 against back EMF when the chime unit turns off.

E. Rodda,
Marion, S.A.

$10



Microphone preamp & peak level indicator

Some modern cassette decks do not have microphone inputs or an automatic recording level system. This electric microphone preamplifier and peak level indicator overcomes this problem.

IC1 forms the preamplifier and is based on a design by EA (Dummy Head Recording Preamplifier, March 1984). Note that the bias on pin 3 is set to 4V by a resistive divider across the output of a 5V, 3-terminal regulator. This ensures that the operating point of the preamplifier and level indicator remains stable for battery voltages down to 6.7V.

IC2 forms the peak level indicator and is an op amp wired as a comparator. The reference input (pin 2) is derived via VR1 which sets the trigger point to between 4V and 5V. The other input (pin 3) is fed from the output of IC1 where audio (up to about 200mV) rides on the 4V bias voltage. The output of IC2 swings high, illuminating the LED, whenever the voltage at pin 3 exceeds the reference input.

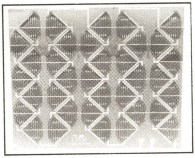
The output of the preamp feeds the AUX inputs of the main amplifier. VR1 is adjusted so that the LED illuminates when the VU meter on the cassette deck displays a peak recording level appropriate to the tape being used.

The circuit can be modified to accept input voltage levels of up to 1V peak by deleting the microphone and the 4.7kΩ biasing resistor and making R1 = 100kΩ and C1 = 19μF.

P. Van Schaik,
Bingara, NSW.

$25

Win this Solar Panel



Altronics of Perth have donated this 18V/7W solar panel as a prize to the reader with the best and most original circuit application involving the panel. Measuring 425 x 385 mm, it delivers 21V into an open circuit in bright sunlight and about 400mA when charging a typical 12V lead-acid battery. If you have an interesting circuit application for this panel, why not submit it for inclusion in these pages? You could win it!

The circuit should be suitable for use with one or more of the panels and should take into account the panel's output characteristics. Normal rates of payment will apply for any applications we subsequently publish. Closing date is May 31, 1986.

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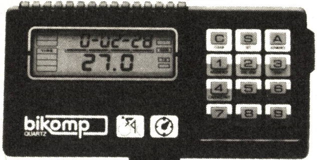
TAX TIME SELLOUT

Yes it's that dreaded time of the year where we have to shell out 1000's of $ of our hard earned cash to the taxman! **So here's your chance to save a fortune** we're clearing $50,000 of these top selling products at never to be repeated prices to overcome our present dilemma — Regards, Jack O'Donnell

Got A Bike? Then Get A Bikomp

Measures Calories Burnt Per Trip Plus an Unbelievable Amount Of Speed and Distance Data

Bicycle Computer



- Instantaneous,Average & Peak Speed Readouts.
- Measures Calories Used per Trip.
- Measures Distance.
- Clock,Stopwatch and journey time(whilst Mobile)
- Miles or Kilometres
- Pacer Tone and Performance Monitor
- Dual Display
- Easy Removal for Security
- Fits to Bike in minutes

D 2050 **Don't Pay $90** **Our Price $39.95**

Get a System for Mum and the Kids

Full Security System Just $79

Fantastic system for this price. Frankly we were amazed at the performance of this very compact system.

Very simple to connect and operate — New Technology has enabled very compact overall dimensions (master unit only 180 x 100 x 65) hence ideal for concealing among book shelves etc.

S 5310 **$79**

Look At the Features

EXIT DELAY 30-35 secs. **ENTRY DELAY** 10 secs. **DC SOURCE** AC adaptor 240/9V DC Supplied **BATTERY BACKUP** 9V Nicad rechargeable (additional Cost S 5024 $14.50) **AUTO RESET** 3 minute operate cycle and auto reset ***RANGE*** Reliable to 30ft. (9M) **LOW BATTERY INDICATOR** Included.

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Out performs our competitors System which incidently seels for around twice the price!

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For checking Microwave Oven Leaks
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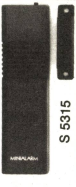
This Month Just $16

Just Arrived Mini Alarm

Fantastic for Door, Window or Cupboard. This great little alarm simply fixed to one surface (usually fixed surface) with the reed switch magnet screwed to the moving door, window sash etc. **Arm the system by simply switching on** Battery drain is miniscule! When door/window is opened **bingo** the surprisingly piercing alarm is operated. Sound Pressure level is 90db at 1ft (300mm) Operates from 9V battery (not supplied) (Alkaline type recommended for long service life).



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From $7.50

Quality Ceiling Grills

Suit 8" Speakers - Great for the Patio etc.

Near 1/2 Price **$1.50ea**

Mini Buzzer 1.5-5V DC

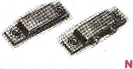
Sensational Low Price

Handy little solid state audio "Buzzer" or signalling device. Just the shot for communicator panels or for timer alarms or in the car. Polarity conscious.

S 5062 **$2.25** **Now $1**

Reed Switch and Magnet Sets

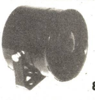
3 Types (Surface Mount)



			Now
S 5153	SPDT	$3.98	$2.95
S 5155	N/C SW	$3.98	$2.95
S 5156	Changeover Type	$4.50	$3.50

High Energy Siren with Swivel Bracket

(As illustrated except white colour)



S 5177

~~$22.50~~

$15

80mm diam.

Absolutely ear splitting SPL 120db. Handy Bracket for wall mounting etc. 12V 300Ma.

Amazing Price Powerful 6000 RPM Mini Drill

FOR PC WORK

Tons of Torque. Just the shot for PCB work. 12V DC operated from external power pack. 1.2mm chuck capacity. Supplied c/w 1mm drill bit

T 2302 **$7.95**

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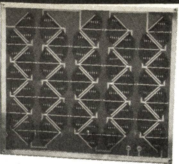
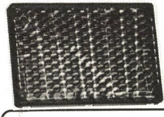
Price Break Through
Solar Cell Array 18V @ 7 Watt



Brilliant New Solar Array at an amazing price. Yes, for less than $90 we now have just the handiest Solar Modules available (why pay Dick Smith $259 for a measly 3 additional watts?? Superb for Powering or Charging 12-15 Volt circuits — Now there's no excuse for that flat Car, Boat or Caravan Battery. Solar Cells are fixed to a fibre board, front covered with tough EPS and rivetted into stainless steel frame.

A 0220 **Dimensions** 385W x 423H x 8D

Amazing Price $89.95



Solar Module .45V 450Ma

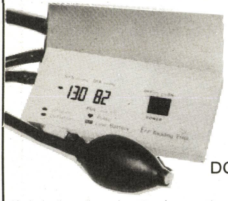
Series or parallel to obtain desired power configuration. (Includes joiner strap for this purpose)

A 0210 **$4.50** 10 Up **$3.98**

Why Risk Unnecessary Heart Attack?

Heart disease strikes down many people in their early 40's (or even 30's). The tragedy remains that had such victims been alerted, remedial medical, physical and dietary action could have been prescribed to avoid illness and in many cases restore full bodily health.

Blood Pressure and Heart Rate Monitor



Features:
- Non-Microphone Measurement System
- LCD Readout
- Blood Pressure Monitor
- Pulse Rate Monitor

New Model

X 3055

DON'T PAY ~~$150~~

$89

Monitoring the cardiovascular system of every member of your family is now an easy and affordable necessity with the X 3055 Digital Blood Pressure Monitor. A built-in microcomputer and the microphone-free measurement system guarantee that all readings are highly accurate. The LCD panel shows readings in large numerals for confident measurements. Special symbols to guide you in operation and clear error messages make it easy for every member of the family to use the X 3055. A built-in miser circuit automatically shuts off power to conserve your battery if the unit is not switched off after use. Inflation by the conventional rubber squeeze bulb and deflation by the pre-settable valve make this unit familiar and easy to use daily. Put the X 3055 in your family's health plan — it's a modest investment in your invaluable health.

BLOOD PRESSURE MONITOR SPECIFICATIONS:

Measuring Method	: Oscillo-Metric Method
Measuring Range	: 0-300 mmHg Cuff Pressure : 40-150 Pulse/Min. Pulse Rate
Acuracy	: Pressure + 3 mmHg (Confirmed A. A. M. I.) : Pulse Rate + 5% of Reading
Pressure Build-Up	: Squeeze Bulb
Deflation Method	: Pre-Settable Exhaust System
Exhaust	: Manual Valve

See Product Review In This Magazine

Brilliant New Digital Multimeter

Autoranging with Memory Function for Relative Measurements

Q 1075 Only **$89.95**

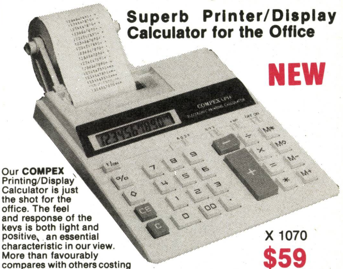
SPECIFICATIONS:

DC VOLTAGE	
Ranges	5 (200mV, 2V, 20V, 200V, 1000V)
DCV Accuracy	0.5% + 1DGT
AC VOLTAGE	
Ranges	4 (2V, 20V,200V,750V)
ACV Accuracy	0.75%+5 DGTS
Input Impedance	10M Ohm Min.
DC CURRENT	
Accuracy	20mA—0.75%+1DGT 10A-1.50%+5DGTS

New Generation Calculators Direct from the Importer

Superb Printer/Display Calculator for the Office

NEW



Our **COMPEX** Printing/Display Calculator is just the shot for the office. The feel and response of the keys is both light and positive, an essential characteristic in our view. More than favourably compares with others costing $50 or $60 more.

X 1070

$59

Amazing Price

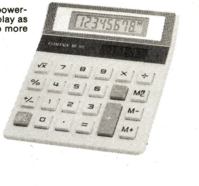
- 10-Digit LCD printing calculator • 9 Entry key buffer memory • Adding machine calculation • Chain and mixed calculation • Full memory calculation • Round-off/down calculation • Percent key with add on/discount calculations • Use normal paper (57.5 mm width) • **Size:** 193x172 x35 mm • **Weight:** 480g

Uses 4 x AA Batteries or Altronics Adaptor M 9001 **$9.95** Additional

Solar Powered

SOLAR DESK TOP CALCULATOR

New technology now allows powering of large desk top type display as used with our new X 1050. No more batteries to go flat. No more Batteries to leak! No more Batteries!! **Perfect for Home or Office**



Fantastic Value

X 1060

Now

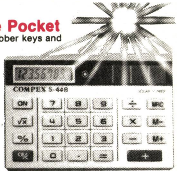
$15

- 8-digit mini desk top calculator • 3-key memory • Percent key with add on/discount calculation • Square root key • Large plus key • **Size:** 123x107 x23.5 mm • **Weight:** 110g

Runs forever without Batteries!!

A Calculator for the Pocket

With positive feel Push Button rubber keys and never needs Batteries.



- 8-digit calculator • Standard four functions (+,—,x,÷) • Full memory calculation • Chain multiplication and division
- Auto-constant calculation
- Square root key • **Size:** 56x84.5 x4.6 mm • **Weight:** 25g

A delightful calculator to use - "Positive feel" keys allow quite rapid operation when compared to standard credit card size pocket calculators. **Should last you a Life Time**

X 1050 ~~$12.50~~ **Now $9**

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FORUM

Conducted by Neville Williams

CrO2 tape: as bad as it's painted?

Is there something wrong with the picture from your VCR? If there is, blame the tape. If there's something different about the particular tape, such as a chromium coating, that's probably responsible. If some other brand of tape appears to work better, that proves the point, doesn't it? You be the judge.

I talked about video tape in the January issue, mainly in relation to the alleged abrasiveness and instability of chromium-based formulations and their supposed tendency to wear heads and guides and/or coat them with layers of gunk shed from the coating.

The discussion revolved around a new Beta video camera, purchased by a NSW reader, which was said to have suffered serious head wear and clogging after only six hours of use with BASF Chromdioxid tape. The owner was advised, in future, to use a non-chromium brand such as TDK.

For reasons stated in the article, we were not prepared to accept the story at face value but, equally, we could do little more than speculate as to what might really have been to blame for the correspondent's unfortunate experience.

Since then, however, we've received a letter from another NSW reader voicing a quite different complaint about BASF tape — one that prompted further inquiries on our part and some interesting answers. But first the letter:

Dear Sir,

I read with interest your Forum article entitled "some rough ideas about video tape".

I no longer buy BASF chromdioxid video cassettes for the following reason. (I have tried other well known brands, with good results, on my AWA-Thorn ATV5 video recorder).

I purchased a BASF cassette from Grace Bros but, when played back, the recording kept changing from colour to B&W, while the level of the sound kept going up and down.

I returned the tape to Grace Bros and they changed it without a fuss (which made me wonder if this often happened with BASF tape). The replacement tape is not better.

I trust this may be of interest to you.

Incidentally, I worked in the AWA Engineering Division for 33 years. My home was built around a recording studio, used for broadcast work.
W.F. (Canterbury, NSW)

Like the letter in the January issue, this one from W.F. was undoubtedly written in all sincerity and will inevitably provide BASF/chromium knockers with a further reason to chant: "I told you so!"

But it also poses the question as to why a well-known and widely-used brand of cassette should exhibit such obvious faults in a particular VCR. A fundamental weakness of that kind in the tape itself would almost certainly have come to our notice.

By way of interest, I called into a Grace Bros store, noting that the shelves in the video section were stacked with a full range of BASF chromium cassettes.

"You must sell a lot of BASF cassettes?", I said.

"Yes, they're very popular."

"Do you get many complaints about their quality or reliability?"

"None that I know of."

"What would happen if somebody did complain?"

"We wouldn't argue. We'd simply replace or refund under guarantee."

So there it is. Are we looking at a tape problem, an equipment problem or a question of compatibility?

Looking back, I recalled having experienced elusive colour dropouts with some early model VCRs; could they still occur for obscure reasons in more recent models?

The logical step was to put the question to technical people connected with major VCR distributors including, hopefully, someone from AWA-Thorn, who handle the ATV5.

Over-zealous cleaning

The first response was scarcely what I expected but is worth recounting, because it has a bearing on what we were talking about in the January issue:

"Yes", I was told, "I read your article on clogged and worn heads, but I'd like to make a suggestion:

"People who get up-tight about head clogging and head wear can easily turn out to be their own worst enemy — especially if they go overboard with cleaning fluids.

"They tend to use far too much of the stuff and don't leave time for it to evaporate properly before loading a cassette.

"What they don't realise is that cleaning fluids may be solvents for the tape coating and, if they're not careful, they can end up re-depositing more gunk around the heads than they removed in the first place!"

It was intended as a general statement, but I remembered that mysteriously clogged Beta camera and the speculative questions posed in the article. Here, apparently, was another one to add to the list: Had the camera been too zealously "cleaned" at some stage, and loaded while still damp?

A spokesman for Sony (Australia) shared our reservations about the Beta camera story in the January issue and, when questioned on the matter, also expressed apprehension about possible abuse of head cleaning fluids. But he added:

"We're just as apprehensive about over-enthusiastic use of abrasive head cleaners. People don't take the instructions seriously; instead of using cleaning tapes for the specified period, they tend to let them run. In one pass, they can cause as much head wear as months of ordinary use!"

(The instructions on Sony's own cleaning tape suggest a 30-second pass but they also say: "If snow or streaks appear in the playback picture, or the picture is all streaks, the video heads **may be dirty.** Use this cassette to clean the video heads, **otherwise do not use.")**

National Panasonic were more outspoken. They dislike any type of head cleaner to the extent that their VCR division will not even endorse an abrasive head cleaner marketed by another section of the same company. I quote:

"In our opinion, the best way to polish video heads in the home is simply to play a new, good quality cassette. The problem with deliberately abrasive cleaning tapes is that there's no way of knowing when you've removed the deposit (if any) and are chewing into the head itself.

"It's crazy to get into the habit of 'cleaning' the heads before every important recording."

The environment

Still on the subject of wear and clogging, both Sony and National stressed the point that too few video photographers heeded the warnings about exposing portable video equipment, such as cameras and camcorders, to dust, sand, salt-spray and abrupt fluctuations in temperature and humidity.

Said the Sony spokesman: "Maybe it's what video photography is all about but I'm sure that a little extra care would save people from some of the hassles they get into."

From National: "It makes you wonder when you find beach sand inside a piece of expensive video gear."

Significantly, video cassettes did not figure in the above exchanges about equipment abuse, apart from the tacit assumption that they should be from reputable manufacturers. Odd-brand tapes, however, were seen as a potential hazard because of uncertainty about surface finish and possible oxide shedding.

But back to the letter from W.F. My contact at AWA-Thorn was aware of stories about BASF chromium dioxide tape, and had dutifully followed them up, without finding any cause for complaint. Not wishing to get involved in brand preference he simply said:

"We haven't experienced any difficulties with BASF Chromdioxid cassettes and we certainly have no reason to discourage our customers from using them."

"So there should be no question of a compatibility problem between your ATV5 and chromium tape?"

"No", he said, "provided that the ATV5 has been correctly set up for the specifications and tolerances governing VHS cassettes manufactured under licence to JVC — and that should certainly include the BASF range."

Tape feed tension

In his opinion, the most likely explanation for the symptoms described was maladjustment of the back tension on the tape from the feed spool. If this is not set correctly, he said, the tape may follow a slightly erratic path as it spirals around the rapidly spinning video drum, leading to mistracking and a possible loss of video — therefore — chroma information.

That sounded logical enough but what about the variation in audio level? Didn't that suggest a physical problem with the tape — a discrepancy in width or some distortion of the edge carrying the audio track, due to a bad slice?

Not necessarily, I was told. Tracking across the fixed audio and control track heads is also sensitive to the tape path around the video drum. Ideally, the complete traverse mechanism should be

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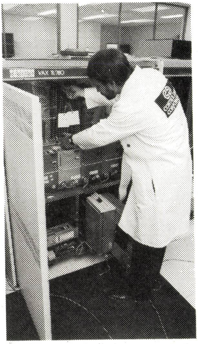


checked out and set up using a standard VHS test tape.

"If it's done properly," said my informant, "back tension should be correct for any tape falling within the surface finish tolerances specified by JVC.

"The problem is that VHS standard test cassettes are both expensive and short-lived and, while we use them ourselves, less well equipped service organisations may not. They may check or adjust VCRs for various functions using any available cassette, without realising that it may itself be at one extreme of the tolerance range.

"I wouldn't be at all surprised if the BASF tape is more highly calendered than most, therefore at the smooth or 'slippery' end of the tolerance range. If your correspondent's ATV5 has been optimised for tapes at the other extreme, it could well account for the problems he's encountered."

That's still only speculation, of course, but it suggests alernative options for W.F:

- He can take the easy way out and simply use those cassettes which work well in his deck. After all, that's what audio tapists have been doing for years!
- Or perhaps he can arrange for the deck (and tape) to be inspected and serviced by AWA-Thorn to resolve the problem and hopefully ensure that it will be compatible, in future, with all intolerance cassettes.

RSI not an injury; "it's all in yer 'ead" (or thereabouts)!

Just when a lot of people seemed to be arriving at some sort of consensus about RSI (Repetitive Strain Injury) two professional groups have released statements which cut right across the most widely accepted scenario.

From Perth . . .

The first statement followed from research work in Perth conducted by Dr John Quinter, a rheumatologist and AMA spokesman on RSI, Dr Adele Thomas (GP), and a manipulative therapist Mr Robert Elvey. Involving 40 "RSI" patients, the Perth study parallels and extends findings from recent overseas research, including extensive workplace studies in Japan.

At the heart of the so-called RSI problem, according to Dr Quinter, is a cervicobrachial disorder, involving nerve tissue in the bony part of the neck which reacts on the forearm region. The effect is said to be broadly similar to that of sciatica, in which nerve problems lower down in the spine cause leg pains.

According to Dr Quinter, the disorder is not unique to work related situations, but can be experienced by the elderly or by people who have suffered neck injuries in the past. Mr Elvey had devised a brachial plexus tension test — believed to be a world first — as a method of assessing arm pains in his patients.

The group findings indicate that the problems experienced by computer keyboard operators "are not caused by repetitive movement but by a prolonged fixed and rotated neck posture", as when bent over a low video screen or documents. Those most at risk are people with previous neck injuries, or with a very long neck, or a dropped shoulder girdle.

From Adelaide, Darwin . . .

From Adelaide, Dr Gwyn Morgan, secretary of The Australian Hand Club, says that RSI as such, is almost exclusively an Australian disease, virtually unknown overseas. This had been verified during a recent visit by an American specialist, sent here by the World Health Organisation.

Yet RSI is costing Australian industry millions of dollars a year, including permanent disability payments.

At a conference in Darwin, 115 member doctors, specialising in the treatment of hand injuries, had agreed almost unanimously, that RSI started out as a fatigue which grew into a neurosis. The pain was real but it was caused by fatigue, which may be heightened by poor working conditions or boring repetitive work.

"People with interesting jobs don't get it," he said.

The current practice of binding the affected hand and treating it as if it were injured only worsened the condition by possibly causing the tendons to shrink.

"A footballer whose muscles hurt at the beginning of the season doesn't go and bind his legs up because, if he did, he would never play again!"

From Canberra

As if those statements were not sufficient, Ms Judith Wall, a stress management consultant and counsellor, and a psychology graduate of the Australian National University, has been awarded the Australian Psychological Society Prize for her Science Diploma research paper on the subject.

Based on a survey of 144 Canberra public servants suffering from RSI, and 79 of their supervisors, she found that they tended to fit a pattern: typically smokers, tense, worriers, subject to crises and likely to view their supervisors as demanding and inconsiderate.

. . . and back again!

Taken together, those reports just about complete the full circle.

As far as this magazine was concerned, debate on the general subject was triggered by a "Forum" article in the June '85 issue, mainly on the strength of the alleged link between RSI and computer style keyboards.

It began with letters from a doctor who described RSI as "a form of mass hysteria" and from other correspondents who pointed out that a similar problem had worried Morse Code operators all of 50 years ago.

It was subsequently claimed that posture and work station layout had a lot to do with the complaint and I tended to support this by recounting my own limited experience. But they/we were outgunned by others who blamed the dynamics of electronic keyboards, culminating in the letter on page 73 of the January issue.

However, in the light of the latest reports, the original doubting doctor doesn't seem quite so isolated in his views, and the posture pedlars have gained a new credibility relative to the keyboard/carpal set. But I guess that the war of words isn't over yet!

LATEST KITS!

PLAYMASTER FM/AM STEREO TUNER

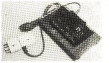
The new Playmaster FM/AM stereo tuner will out perform anything presently available on the market, regardless of price. As well as including a FM tuner section which is every bit as good as any other synthesised design, it is also the only unit featuring a genuine wideband, low distortion AM stereo tuner. Naturally, it has a digital readout, 12 station memory, automatic seek and an optional infrared remote control.
(EA Dec. '85 Jan-Feb '86 85tu12)
Cat. K86020 **$399**

THE BUSKER PORTABLE AMPLIFIER

This handy amplifier is completely portable and is capable of operating from either the mains or a 12V battery. Main features include guitar and high-level inputs, an inbuilt loudspeaker, and bass and treble controls. Its just the thing for busking or for guitar practice.
(EA Feb. 85 85ba2)
Cat.K85020 (excluding cabinet)**$99**

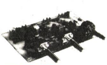
SONICS ACTIVE DIRECT INSERTION BOX.

This inexpensive, easy to build DI box was designed in conjuction with Sonics magazine and is fine for both live PA and home recording work. It takes an unbalanced input and produces an output suitable for driving a balanced audio line.
(ETI 1401 Sept '85)
Cat. K41401 **$39.95**



"HANDS FREE" OR LOUDSPEAKER TELEPHONE ADATOR

This attractive desktop unit enables "Hands Free" two way conversation over the telephone. The advantages of being able to engage in a telephone conversation with both hands free to take notes, look up information, perform calculations or to operate a computer keyboard are both obvious and desirable. Now you can enjoy all the benefits for less than $80!
(EA Nov. '85)
Cat. K86030 **$79**



PREAMP FOR PAGING AMP

A versatile preamp with separate bass, treble and volume. (ETI 1421)
Cat. K54210 **$24.95**

NAIL FINDER

Essential for electricians and handymen. The Nail Finder will help locate timber studs behind Gyprock or plasterboard wall surfaces, as well as locating pipes and wiring behind walls. (EA Oct. '83)
Cat. K83100 **$11.95**

ELECTRIC FENCE CONTROLLER

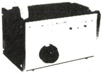
Restore discipline to the farm or allotment with this new electric fence controller. It features higher output power and lower current drain than the previous design for use in rural areas.
(EA Dec.'85, 85ef11)
Cat.K85110 **$44.95**

VIDEO FADER CIRCUIT

Add a touch of professionalism to your video movies with this simple Video Fader Circuit. It enables you to fade a scene to black (and back again) without loss of picture lock (sync) or colour.
(EA Jan '86, 85tf10)
Cat.K86010 **$19.95**

TOUCH LAMP TIMER

Just a quick dab with the fingers and this touch switch will turn on lights or most mains-powered appliances for up to 10 minutes.
(EA August '83, 83pc3b)
Cat. K83084 **$21**



12-240V DC-AC INVERTER

INLCLUDING 300 WATTS TRANSFORMER

This EA inverter is capable of driving mains appliances rated up to 300VA and features voltage regulation and full over load protection.
(EA June '82) 82IV6
Nominal Supply: Voltage 12V DC
Output: Voltage see table
Frequency: 50Hz + − 005%
Regulation: see table
Maximum Load: 300VA
Current Limiting: 30A (primary)
Efficiency: see table

Resistive Load Watts	Output Voltage (RMS)	Input Current (A)	Efficiency (%)	Battery life 40Ah/20h Rate (minutes)
0	210	1.2	0	-
40	235	4.5	60	240
100	240	11.3	62	80
140	240	15.0	69	60
200	240	20.1	78	50
240	240	24.0	79	32
300	235	29.6	82	28

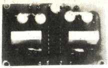
P&P $10.00 Anywhere in Australia
Cat. K82062 **$195**

50V 5A LABORATORY POWER SUPPLY

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.
(Ea May,June'83) 83PS5
Cat. K83050 **$169**

TEMP PROBE

Can measure temperature from -50c to 150c. It simply plugs into your multimeter - great for digital multimeters. Accuracy of 0.1c resolution of 0.1c.
(ETI June'83) ETI 153
Cat. K41530 **$26.95**



GENERAL PURPOSE PREAMPLIFIER

A general purpose stereo preamplifier using a single LM382 IC which can be tailored for use with magnetic pickups, tape recorders or microphones by changing a few components. (ETI445) (ETI July '76)
Cat. K44490 **$9.95**

GENERAL PURPOSE AMPLIFIER CLASS B

One of the handiest 'tools' for the electronics experimenter is a genuine purpose audio amp. This module will work from a wide range of supply voltages, has good sensitivity, is robust and reliable - easy to build too! (ETI 453)
(ETI April '80)
Cat. K44530 **$14.95**

150W MOSFET POWER AMPLIFIER

Here's a high power, general purpose 150W Mosfet Power Amp Module! Suitable for guitar and P.A. applications and employing rugged, reliable Mosfets in the output stage. (ETI 499) (ETI March '82)
Cat. K44990 **$97.50**
(Heatsink not included)
plus transformer **$49.50**

EA AM STEREO DECODER

AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system.
(EA Oct.'84) 84MS10
Cat. K84100 **$26.95**

EFFECTS UNIT

An "effects unit" that can create phasing, flanging, echo, reverb and vibrato effects.
(EA June.'83) 83GA6
Cat. K83060 **$89.00**

4 INPUT PREAMP

Easy construction and versatile operation, this preamp is for coupling with the 300W "Brute" Power Amp. (ETI 467) (ETI July '80)
Cat. K44670 **$54.95**

BALANCED INPUT PREAMP

This project can be used as a balanced mic amp. with low impendance input, a low or high impendance input differential amplifier or a balanced input instrumentation amplifier.
(ETI-461) (ETI Dec.'82).
Cat. K44610 **$19.95**

PLAYMASTER 300 WATT AMPLIFIER

This module will deliver up to 200 watts into an 8 ohm load and up to 300 watts into a 4 ohm load. Comprehensive protection is included and a printer circuit board brings it all together in a rugged easy-to-build module. It can be built in either fully-complemetary or quasi-complementary versions, so output transistor shortages should be no problem at all.
(80PA6) (EA July '80)
Cat. K80060 **$97.95**

SERIES 4000 STEREO PREAMP

This high performance project is designed to complement ETI's 60 watt low distortion amplifier module and forms part of a complete stereo system, the "Series 4000" project. (ETI 471)
(Top Projects Vol. 6)
Cat. K44710 **$59.95**

MICROBEE ENHANCER 1

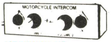
This amazing kit for the Microbee is a must for all Microbee owners!

Most expansion units up to this time offered at best only one or other features; and this made it impossible to run, for example, complex sound effects mingled with speech. The Enhancer 1 will do all this and much more as well. It is quite amazing how much has been shoe-horned into this compact unit.
The Enhancer 1s' many powerful features inlcude....

- Two ATARI/COMMODORE/COLECO/SEARS type joystick inputs.
- Two TRS COLOUR COMPUTER type joystick inputs.
- Allows the connection of Touch Pads, Paddles, Proportional Joysticks, Trakballs, Mice, temperature senors, lights level sensors, transducers, etc, etc!!
- A 4 voice music/sound effects sythesizer.
- A real time clock.
- Unlimited vocabulary speech synthesizer (option).
- Parallel printer interface (option)
- A built-in speaker with volume control.
- Listings of all necesary routines for use.
- An impressive demonstration program package.
- Compatible to all Microbees.
- Digital recording and playback of speech and sound.
- An 8 channel analog to digital converter with variable voltage or variable resistance type analog inputs and also user selectable resolution from 1 to 9 bits.
- A digital to analog converter with selctable resolution from 1-8 bits.
- Allows automatic data acquisition and logging.
- 5 digital input lines, 4 digital ouput lines.
- A voice input channel.
- A 40 pin experimenter socket with all 8 analog inputs, 5 digital inputs, 4 digital ouputs, 3.58 MHz buffered clock, sound output (so that you can play the sound effects through your HI FI), 3 high resolution voltage comparators, DAC output etc.

The amazing Microbee Enhancer is available exclusively from Rod Irving Electronics.

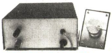
$149



MOTORCYLCE INTERCOM

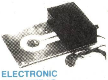
OVER 300 SOLD!

Motorcycling is fun, but the conversation between rider and passenger is usually just not possible. But build this intercom and you can converse with your passenger at any time while you are on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build!
(EA Feb.'84) 84MC2
Cat. K84020 **$45.00**



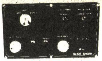
RAILMASTER PULSE POWER TRAIN CONTROLLER

Here's an up-to-the-minute train controller offering all the most desirable features including inertia, full overload protection, walk-around throttle and excellent low-speed running characters. Probably the best controller available, regardless of the cost!
(EA Sept.'84) 84TC9
Cat. K84091 **$79.50**



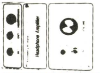
ELECTRONIC MOUSETRAP

This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again!
(ETI Aug.'84) ETI 1524
Cat. K55240 **$34.95**



SLIDE CROSS-FADER

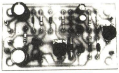
Want to put on really professional slide show? This slide cross-fader can provide smooth dissolves from one projector to another, initiate slide changing automatically from an in-built varialbe timer, and synchronise slide changes to pre-recorded commentary or music on a tape recorder. All this at a cost far less than comparable commercial units. (EA Nov.'81) 81SS11
Cat. K81110 **$89.00**



HEADPHONE AMPLIFIER

PRACTICE WITHOUT ANNOYING THE FAMILY!

If you play any type of electronic instrument,this headphone amplifier will surely interest you. It will let you practice for hours without upsetting the household,or you can use it to monitor your own instrument in the midst of a rowdy jam session. (EA Feb.'84) 83MA11
Cat. K84111 **$29.95**

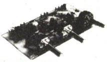


1W AUDIO AMPLIFIER

A low-cost general-purpose,1 watt audio amplifier, suitable for increasing your computers audio level, etc. (EA Nov.'84)
Cat. K84111 **$9.95**

COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER

Here's what you've been asking for, a full trasmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Microbee tips are avaialble on interfacing the unit to other computers. (ETI Nov '84) ETI 755)
Cat. K47550 **$139**

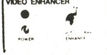


PREAMP FOR PAGING AMP

A versatile preamp with separate bass, treble and volume. (ETI 1421)
Cat. K54210 **$24.95**

15V DUAL POWER SUPPLY

This simple project is suitable for most projects requiring a dual voltage. (ETI 581, June '76)
Cat. K45810 **$19.50**



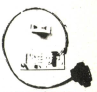
VIDEO ENHANCER

100's SOLD

Like tone controls in a hi-fi amplifier, touch up the signal with this Video Enhancer. (EA Oct.'83) 83VE10
Cat. K83100 **$39.50**

MICROBEE SERIAL-TO-PARALLEL INTERFACE

Most microcomputers worth owning have an 'RS232' connector, or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel 'Centronics' interface printers . Save money by building this interface. (ETI Jan.'84) ETI 675
Cat. K46750 **$59.50**



RADIOTELETYPE CONVERTER FOR THE MICROBEE

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too. (ETI Apr.'83)
Cat. K47330 **$19.95**

FAIR DINKUM RS232 FOR MICROBEE

The Microbee, among other home computers, has a 'sort of' RS232 port in that it doesn't implement negative-going portion of its ouput signal (TxD). Most peripherals with an RS232 input can cope with that, but inevitably, there are those that can't. This project fixes that.
(ETI 676, ETI FEB '84)
Cat. K46760 **$59.50**

CYLON VOICE

Have your voice transformed into that of the sinister sounding Cylons. Great fun and scary! (EA Jan '81)
Cat. K80012 **$19.95**

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Errors and Omissions Excepted.

CD adaptor for your car

Have you ever wanted to fit a CD player to your car but were scared off by the high cost? This simple circuit will allow you to use one of the new portable CD players.

by COLIN DAWSON

Car CD player prices start at about $900 and go up from there. That's enough to scare off all but the most dedicated car sound enthusiasts.

But there is a way of fitting a CD player to your car "on the cheap" — or at least at a somewhat less exorbitant cost. Instead of a car CD player, you can use one of the new portable CD players such as the Philips CD10, the Sony D-50 and the Technics SL-PX7.

Because they are designed for portable use, these players resist bumps and vibration very well and are thus quite suitable for use in a car. They are also a lot cheaper than a car CD player and can be used virtually anywhere.

Rather than use headphones in the car (which is dangerous), the best scheme is to interface the CD player to your existing car sound system and power it from the car battery. But there are a couple of problems. Portable CD players require a regulated 9V supply rail and the output level must be matched to the amplifier inputs.

That's where this simple circuit comes in. It accepts a 12V input from the car battery and provides a regulated 9V rail to power the CD player. In addition, it includes a switchable signal attenuator so that the output of the CD player can be adjusted to the correct level.

By selecting the right level of attenuation, the amplifier volume control can be used over its normal range rather than being restricted to the lower end of the scale. In addition, the system will be free of any unpleasant distortion due to signal overload.

In use, the adaptor circuit is simply connected between the CD player and the amplifier (or radio/cassette player) via two pairs of RCA sockets. A third pair of RCA sockets accepts the outputs from the radio/cassette player and can be switched through direct to the amplifier via the attenuator switch.

Circuit description

The regulator circuit is based on an LM317 adjustable regulator, set to deliver a fixed 9V output. This approach is necessary since there are no readily available 9V regulators.

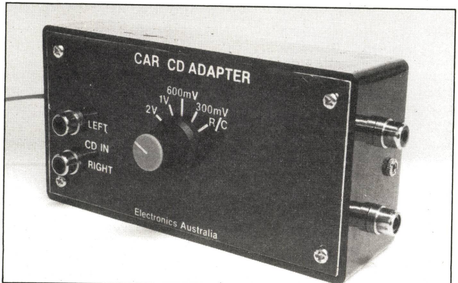
The circuit works like this: In operation, the LM317 maintains a nominal 1.25V output between its out and adjustment terminals, although the actual output can be anywhere between 1.2 and 1.3V. This fixed voltage is applied across a 120Ω resistor which forms part of a voltage divider network.

Because the current drawn by the adjustment terminal is negligible, approximately 10mA flows in the 120Ω resistor and this current also flows in the 820Ω resistor. As a result, the adjustment terminal is "jacked up" to 8.2V and the total output voltage is thus 8.2 + 1.25V = 9.45V.

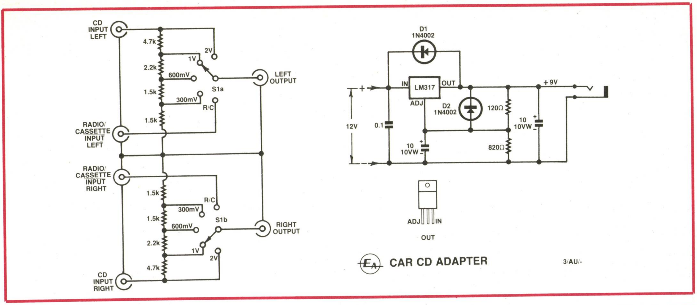
While this is slightly higher than the required 9V rail, it is close enough for practical purposes.

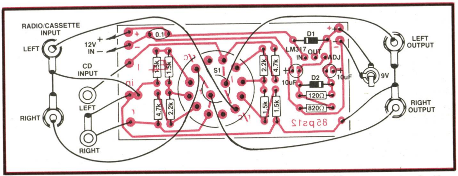
However, if the regulator output is at the high end of its range (ie, 1.3V), the total output voltage will be around 10.2V. In this case, the output will have to be reduced by shunting the 820Ω resistor. More on that later.

Although not strictly necessary, diode D1 protects the regulator IC from damage if the circuit output is connected to an external supply voltage greater than the regulator input voltage. D2 protects the LM317 against output short circuits.



The CD player is simply plugged into the two front-panel RCA sockets.





Most of the parts are mounted on a small PC board. Take care with component polarity.

Note that D1 and D2 are normally reverse biased and play no part in the circuit operation.

The switchable attenuator circuit is virtually identical to that published in our January 1986 issue. It employs a 2-pole rotary switch to select either the radio/cassette player or four levels of signal attenuation from the CD player, corresponding to nominal output levels of 2V, 1V, 600mV and 300mV.

Construction

Most of the parts are mounted on a small PC board coded 85ps12 and measuring 91 x 45mm. No particular order need be followed when installing the parts, although the rotary switch should be left until last.

Note carefully the orientation of the two diodes and the 3-terminal regulator. The regulator should be soldered into circuit at full lead length and then bent over at right angles (otherwise it will foul the front panel).

With the board assembly completed, attention can be turned to the case. We used a plastic utility case measuring 130 x 67 x 40mm. This was fitted with a Scotchcal adhesive label to provide an attractive front panel.

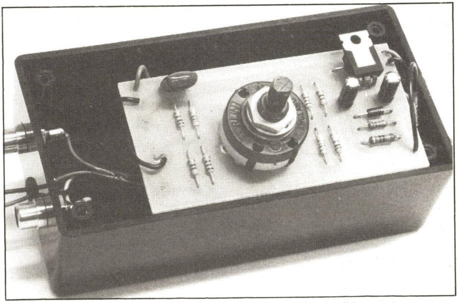
Before fitting the Scotchcal label, it should be sprayed with a hard-setting clear lacquer (eg, Estapol) to prevent scratches. This done, the label may be carefully affixed to the lid and used as a drilling template for the front panel.

In addition, holes must be drilled in the side of the case for the radio/cassette RCA input sockets, the output RCA sockets and the power input leads. The latter should pass through a small rubber grommet.

The various items of hardware can now be mounted and the PC board secured to the back of the lid by means of the rotary switch. Note that solder lugs should be placed under the RCA socket nuts to terminate the earth connections from the PC board.

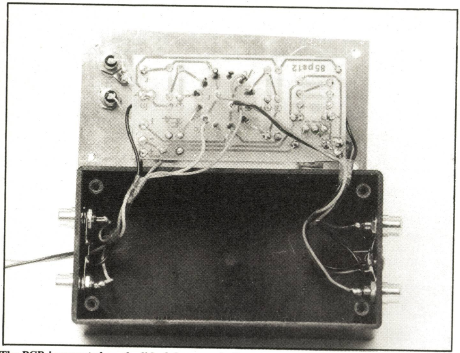
Once construction has been completed, the unit should be tested for correct output voltage. To do this, connect the power input leads to the car battery and measure the output voltage with a multimeter. If the output measures more than 9.5V, it should be reduced by shunting the 802Ω resistor with 8.2kΩ.

The additional resistor can be installed on the back of the PC board.

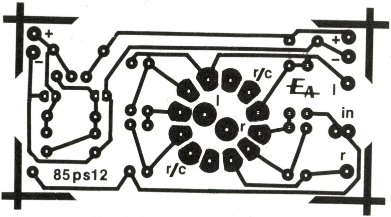


This view shows the assembled PCB, prior to mounting on the case lid.

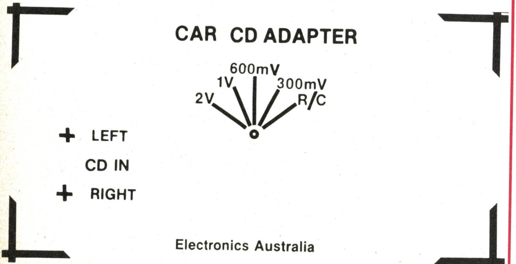
CD adaptor for your car



The PCB is mounted on the lid of the case vis the rotary switch.



Above is the actual-size PC artwork.



Above: actual size artwork for the front panel.

Installation

The Car CD Adaptor is most easily connected to car stereo systems which have a separate power amplifier, or direct access to the power amplifier inputs. Normally, the amplifier inputs will be connected to the left and right channel outputs of the radio/cassette player.

All you have to do is disconnect the radio/cassette outputs and connect them to the appropriate inputs on the adaptor. The CD player connects to the left and right inputs on the front panel, while the adaptor outputs go to the amplifier.

Note that shielded leads should be used for all input and output connections. Most amplifiers use RCA socket connectors, although a few still use DIN sockets. Terminate the leads as appropriate.

Power for the Car CD Adaptor should be derived from the amplifier power supply lead. Note that in most cases, power for the amplifier is switched by the radio/cassette player, either directly or via a relay. This means that the radio/cassette player must be switched on at all times, even when the CD player is selected.

If your car stereo system doesn't use a separate amplifier, then the job is a little trickier. Briefly, this will involve breaking into the signal path just before the power amplifier stages. The volume control pot is usually the best place to do this.

PARTS LIST

- 1 PC board, code 85ps12, 91 x 45mm
- 1 LM317 adjustable regulator
- 1 2-pole, 5-position rotary switch
- 6 panel mounting RCA sockets
- 5 solder lugs
- 1 3.5mm jack socket and plug
- 1 plastic project box, 130 x 67 x 42mm
- 1 Scotchcal adhesive label, 125 x 62mm
- 1 rubber grommet
- 2 1-metre lengths of hook-up wire

Capacitors

- 2 10μF 16VW electrolytic
- 1 0.1μF metallized polyester (greencap)

Resistors (0.25W, 5%)
1 x 8.2kΩ (see text), 2 x 4.7kΩ, 2 x 2.2kΩ, 4 x 1.5kΩ, 1 x 820Ω, 1 x 120Ω.

PRE 'CATALOGUE RELEASE'

BARGAINS

RF SIGNAL GENERATOR

Inexpensive generator that checks and aligns IF circuits, tuners, etc. 100kHz - 150MHz frequency range in 6 overlapping ranges with +/-1.5% accuracy. RF output: 100mV rms approx. (up to 35MHz). Modulation: 1kHz internal, 50Hz-20kHz external. Audio output: 1kHz/1V rms, fixed. Crystal oscillator: 1-15MHz external with FT243 holder. Supply voltage: 240V
Cat Q-1312

$129

SAVE $20

AF SIGNAL GENERATOR

A 'pigeon pair' for the RF signal generator Q-1312 opposite. Square/sine wave output with wide 20Hz - 200kHz frequency range. Highly accurate: +/- 3% - 2Hz. High/low unbalanced output control (-2000dB) with a fine adjuster. 20Hz - 20kHz sine wave output: 5V rms maximum at 1% or less distortion. 20Hz, 10V (p-p maximum) square wave output: 0.5us rise time. Synch: +/-3% of oscillator frequency per V rms.
Cat Q-1310

$129

SAVE $20

HI POWER 2m FT-209RH

Hand-held Yaesu transceiver with more than just a 'hand full' of features. 10 Memories for favourite repeaters, simplex channels and even repeater split. Convenient keyboard entry for frequency and memory. LCD displays frequency, repeater split and memory channel. Yaesu's renowned Power Saver System conserves the battery by activating the receiver for periodical checks. Boasts an impressive 5 watt ouput.
Cat D-3503

$399

GALAXY LCD PANEL METER

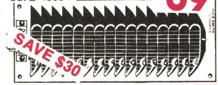
3.5 Digit, 200mV FSD panel meter makes an ideal replacement for analogue meters which are susceptible to movement. LCD display provides accurate readout and can be seen even under adverse light conditions.
Cat Q-2200

SAVE $10 **$39.95**

8V/180mA SOLAR PANEL

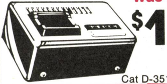
Gathers the Sun's rays and generates enough power to operate small appliances like a radio or tape player PLUS perform solar experiments. Campers will find it a practical benefit out in the bush while schools and Techs can apply it to studies.
Cat Z-4860

$69


SAVE $30

YAESU NC-15 QUICK CHARGER

Cradle-type charger/supply offering fast charging of either FNB-3 or FNB-4 Ni-Cads (approx. 2-3 hours) with automatic charge sensing. Doubles as a handy base supply. **Was $159**



$129
SAVE $30
Cat D-3513

CAPACITORS AT BARGAIN PRICES!

DESCRIPTION	CAT No.	WAS	NOW
Cap Tant 25V 10MFD	R-4750		.85
Cap Green 100V 5PCT .1MFD	R-2100		.28
1/4W Resistor Pack (300 piece)	R-7010		$6.95
Cap Electro RT 10V 100MFD	R-4125	.40	.32
Cap Electro RG 75V 8000MFD	R-4590	$14.95	$11.95
Ceramic 50 Volt .01uF	R-2321	.15	.12
Capacitor Pack-Polyester	R-7040	$9.95	$7.95
Cap Electro RB 25V 1000MFD	R-4450	.95	.75
Cap Tant 35V .1MFD	R-4700	.65	.50
Cap Green 100V 5PCT 0.01MFD	R-2055	.25	.20
Cap Tant 6.3V 47MFD	R-4770	.85	.65
Resistor Pack 1% 300PC's E24	R-7020	$17.95	$14.35
Cap Eectro RB 25V 4.7MFD	R-4310	.22	.17
Capacitor Pack-Ceramic	R-7050	$4.95	$3.95

Save 20% & more on purchases over $100 for one month only or while stocks last

DICK SMITH ELECTRONICS

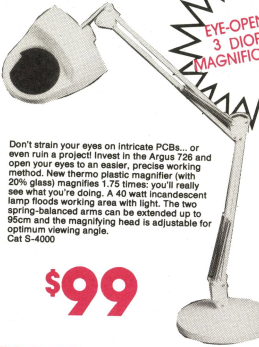
B.153A/MM

PRE 'CATALOGUE RELEASE'

NEW! JUST WHAT THE HOBBYIST ORDERED...

ARGUS 726 MAGNIFIER WITH LAMP FOR CLOSE UP WORK

EYE-OPENING 3 DIOPTER MAGNIFICATION!



Don't strain your eyes on intricate PCBs... or even ruin a project! Invest in the Argus 726 and open your eyes to an easier, precise working method. New thermo plastic magnifier (with 20% glass) magnifies 1.75 times: you'll really see what you're doing. A 40 watt incandescent lamp floods working area with light. The two spring-balanced arms can be extended up to 95cm and the magnifying head is adjustable for optimum viewing angle.
Cat S-4000

$99

SUPER SOLDER SPECIALS!

If there's one thing every hobbyist, handyman or serviceman needs it's solder... and DSE have solder for every job!

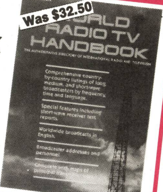
Corrosion-free multicore solder. 1.25mm (18g), 200 grams. Cat N-1619	**Was $6.50**	**$5**
0.75mm (22g), 200 grams. Cat N-1623	**Was $6.50**	**$5**
Hobby Pack: 0.75mm (22g) Cat N-1636	**Was $1.30**	**95¢**

DICK SMITH ELECTRONICS
PTY LTD

B.153B/RE

BOOKS

SPECIAL! '85 WORLD RADIO & TV HANDBOOK

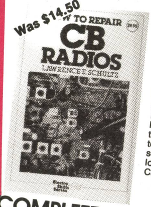


1/2 PRICE!

While Stocks Last.

International standard reference book containing a comprehensive listing world-wide radio and TV stations: frequencies, addresses, call signs, IDs, etc. Plus special interest feature articles written by experts. Even though it's last years edition there's a wealth of relevant data.
Cat B-2085

$16.25



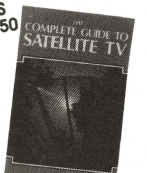
HOW TO REPAIR CB RADIOS

If you own a CB this inexpensive book is invaluable! It guides you through the maze of technical data in clearly written, plain old English. Handy trouble shooting hints may save you time and trouble. Your CB is too valuable to be out of action... and with this sensational book it won't be for long.
Cat B-2330

$9.50

COMPLETE GUIDE TO SATELLITE TV

WAS $17.50



The Bible of TVRO reception by expert Martin Clifford. Details siting and installing base stations, specifications on satellite orbit-uplinks and downlinks. Everything you could ever possibly want to know is in this 250 page book!
Cat B-1841

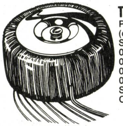
$13.50

See page 70 for address details

BARGAINS

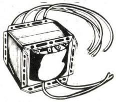
Need a transformer?

DSE have an array of transformers for almost every conceivable application: trade, hobbyists... you name it! And even better news: now you can SAVE $$$! Check out the transformers below. There's bound to be one for your particular requirements.



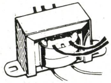
TOROIDAL
Primary windings: 0-240V at 3.33 A rms (orange - orange).
Secondary windings:
0-45V at 3.33 A rms(red - yellow).
0-25 V at 3.33 A rms (blue-grey).
0-15V at 200mA rms (green - violet).
0-15V at 200mA rms (black - white).
Standard wiring tolerance: +/- 5%.
Cat M-1600

$49 SAVE $10



M-0150
Primary: 240V, 50Hz.
Secondary voltage: 2x47V, 2x15V.
Secondary current: (47V)3A ea, (15V) 0.5A, (total 300VA).
Terminations: Flying leads.
Cat M-0150

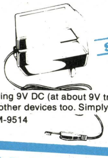
SAVE $10 **$\$39^{95}$**



DSE2840
Primary: 240V, 50Hz.
Secondary voltage: 4.5-0-4.5V.
Secondary current: 150mA.
Terminations: Flying leads.
Cat M-2824

SAVE $1.25 **$\$2^{50}$**

Power Supply



9V DC/200mA

SAVE $2.00 **$\$6^{50}$**

For all equipment requiring 9V DC (at about 9V transistor battery drain) — many other devices too. Simply plugs into 240V mains. Cat M-9514

FREE POWER!

14.5V SOLAR PANEL

SAVE **$40**

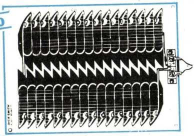
ONLY **$159**

Cat Z-4850

Produce electricity from the most reliable source in the Universe: the Sun... and it's free! Campers, bushies, boat owners and even hermits can enjoy some creature comforts miles from civilization. Add a rechargeable battery, and the panel should be able to give you enough oomph for, say, a black & white portable TV set, CB, etc. Provides 5W maximum (+/-10%)typical. 14.5V and 350mA at maximum output. Easy to install, measures 34.7 x 33cm and weighs only 1.4kg. Supplied with 1.8m 16 gauge cable.

MINI SOLAR PANEL

SAVE $50



Compact electricity generator for hikers, RV owners, yachties... anyone who needs to power appliances or recharge batteries. Measures only 6⅜" x 8 ⅝" x 3/16" and weighs a mere 13oz. So it's small enough to pack a ruck sack, etc. Produces an impressive 16V/180mA output for a range of applications: add a rechargeable battery and its capabilities are greatly extended. A must for your camping trip!

Cat Z-4855

Was $149 **$99**

DOUBLE THE FUN

Double the fun! Buy any of these DSE FunWay kits and choose another (of these!) absolutely FREE!

Binary Bingo Cat K-2668	$10.95
Electronic Two Up Cat K-2661	$5.95
Electronic Lil Pockey Cat K-2662	$11.95
Mini Colur Organ Cat K-2664	$5.95
Electronic Minder Cat K-2660	$3.95
Flashing Brooch Cat K-2621	$2.95
Wireless Microphone Cat K-2631	$6.95
Light and Sound Cat K-2665	$4.95
Combination Lock Switch Cat K-2666	$7.95

See page 70 for address details

B.153C/RE

PRE 'CATALOGUE RELEASE'

CABLES & WIRES

Cable, Mini Spi Twin Lo Volt	W-2010	Was .25	**Now .20**
Cable, Mini Twin Heavy Duty	W-2012	Was .30	**Now .24**
Twin Shield Flex PVC Cover	W-2037	Was .90	**Now .70**
Cable, SC4 for Shield	W-2038	Was $1.30	**Now $1.05**
3 core power m/plug; 1.8m	W-2057	Was $1.95	**Now $1.55**
Cable, rainbow 12 core	W-2045	Was $1.45	**Now $1.15**
Cable, SC1 shielded single	W-2030	Was .35	**Now .25**
Wire H/H, 23/0.20 Red	W-2260	Was .25	**Now .20**
Wire H/U, 32/0.20 Blue	W-2282	Was .35	**Now .25**
Wire H/U, 10/0.254 Red	W-2240	Was .18	**Now .13**

WHILE STOCKS LAST

SAVE A MASSIVE 20% OFF R.R.P.!!

WOW! PLUS IF YOU PURCHASE 100m ROLL A FURTHER 5% OFF

SUNNY

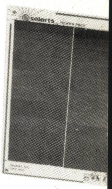
20V/500mA SO

We all know that the Sun is more than a
constant source of power to generate
variety of appliances. AND it's one of th
ible. With a solar panel you can harness
on picnics — or even more serious app
pletely weather and shock proof; meas
weighs less than 0.5kg! Easy to install;
Cat Z-4844

WOW!

Was $259

$199



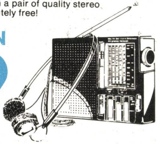
6 BAND RADIO WITH HEADPHONES!

One of the most affordable introduction into shortwave istening you'll find anywhere. Tune into local AM/FM station PLUS 4 shortwave bands: 2.3 -4.1MHz, 4 - 7.5MHz, 7.5 - 15MHz and 15 - 26MHz. Compact size makes it ideal for home and outside enjoyment. And it comes complete with a pair of quality stereo headphones - absolutely free!
Cat D-2835

BARGAIN

$39

Was $59

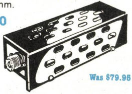


300W DUMMY LOAD

50 Ohm ceramic resistor with high overload tolerance... handles 300W for 30-seconds, 75W for 8-minutes. Fitted with an S0-239 connector. Offers a VSWR of less than 1.1:1 from DC to 30MHz, and 1.5:1 max. to 150MHz. Size: 45x55x155mm.
Cat D-7030

SAVE $10

JUST $69.95

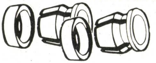


Was $79.95

LED MOUNTING BEZELS FR 5mm... Pk/15.

When making up projects that have LED power indication or otherwise, why not 'dress up' you LEDs for that added professional touch. Our reduced price makes them even more affodable than ever: 5 cents each!!

Cat H-1910



Were $1.05 75¢

ADJUSTABLE CABLE CLAMP

Heavy-duty nylon inter-locking clamps with adjustable diameter. Use for securing computer or mains cables, terminating power cords, etc. Pk. of 5.
Cat H-1972

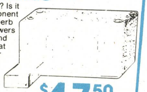
SAVE $1.00

$1.50

COMPONENT CABINET WITH 16 DRAWERS

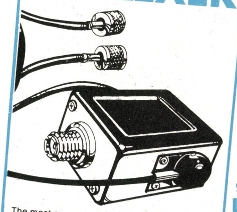
SAVE $5.00

Tired of loosing bit 'n pieces? Is it hard to find the exact component you want? You need this superb cabinet: 16 see-through drawers store all your components and organise them, so they'll be at your finger tips. Each drawer features a handy divider for total convenience.
Drawers: 65x137x35mm.
Over-all cabinet size: 300x180x140mm.
Cat H-2588



ONLY $17.50

DUPLEXER



The most convenient accessory for amateurs since 'mega hertz' was invented! Now you can connect a 6m and 2m radio to ONE antenna. Ideal for both base stations and moble use. Simply connect your 6m and 2m into the duplexer, then a single connection to your antenna. Talk about economy of space (especially in a car)... our DSE price is even better economy.
Cat D-3555

$54.50

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BARGAINS

)WER

ANEL

anning our bodies. It's a
capable of operating a
t efficient means poss-
– in the bush, camping,
n isolated areas. Com-
266 x 240 x 5mm and
vith instructions.

VE $$$...

NNECTOR BOX

ltimate! A sturdy plastic carry case for
s of pieces: assorted lugs, connectors,
rommets, clips and ties. Over 20 handy
ments for real convenience. No hobbyist,
an or technician should be without one.
)98

$34.95

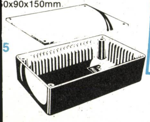
9⁹⁵

GAIN
OVER 40%

E 'ZIPPY' BOX

e DSE Zippy Box prefered by
n the 'know'! Why are they so
s their versatility. Deep ribbed
eal for mounting PCBs without
bout screws... and PCBs can be
ngth wise or across the box.
ose-fitting aluminium lid (screws
50x90x150mm.

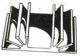
5



HEATSINKS

AT RED HOT PRICES...

Every hobbyist knows that if a project produces a lot of heat, and you're limited for space, aluminium heatsinks are the best (the only) solution! They dissipate heat in a variety of projects such as amps, ICs, etc. And now the DSE selection of heatsinks is avaliable at red hot price.....



HI EFFICIENCY POWER HEATSINK.

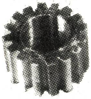
Thick base, radial fin dseign. Dissipates huge amounts of heat; Thermal resistance to ambient -1 degree/watt (at 2 ft/sec forced air flow); temperature rise above ambient with no forced air flow 60 degrees at 30W heat dissipation level.
Cat H-3422

SAVE $1 **$3⁵⁰**

UNIVERSAL HOLE PATTERN

Suits virtually all power type semiconductors. Ribbed walls and black anodised finish for maximum efficiency.
Cat H-3401

95¢

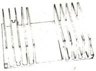


ROUND TO-5

Manufactured to exacting tolerances to ensure snug fit and optimum heat transfer on TO-5 cases. Massive body allows rapid heat dissipation.
Cat H-3412

Save 50% **30¢**

Were.65c



PRE-DRILLED POWER HEAT SINK

Ingenious design allows it to be mounted either flat on a panel, or at angles (insidc a case). Side fins feature tongue and groove so they can be joined sideways. Pre-drilled. Takes two TO-3s. 78x110x33mm.
Cat H-3461

Were $5.95 **$3⁹⁵**

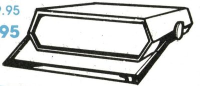
PROJECT CASE

A superb plastic case for projects or commercial applications. Boasts all the features that make life easier for the hobbyist: PCB mounting slots and posts, transformer mounting posts, ventilation and speaker (sound) slots... the lot! Size: 260x190x80mm.
Cat H-2507

Was $19.95

$14⁹⁵

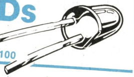
SAVE $5.00



PREMIUM QUALITY 'RED' LEDs

$16⁹⁵ Per pack of 100

Sensational value that's hard to beat! When your project really counts, you can count on these premium quality red, 5mm LEDs.
Cat Z-4084



STEREO SIMULATOR KIT

Like to hear all those favourite old video movies in stereo? Now you can! It's easy and inexpensive. This marvelous DSE kit takes just a little time and presto... your VCR will sound like a new (and expensive) entertainer. It turns almost any mono signal into surprisingly good synthetic stereo.
Cat K-3421

$17⁹⁵

Was $23.95

WOW! As described in EA

ULTRA- FIDELITY PREAMP

A magical kit that can improve the performance of your amplifier. The popularity of CD players has lead to an increased burden on many amps: higher signal slopes, dynamic range, etc. This easy to assemble kit has been designed for improved dymanic range, noise, distortion and frequency response characteristics. Maximum output: >20V rms. Freq. response: +/-0.2dB typical with 1% components. THD: <0.001%/100 mV, 100Hz-10Hz(MM cartridge); <0.004%/100 mV, 100Hz-10kHz (MC cartridge).
Cat K-3037

$59⁹⁵

Was $69.50

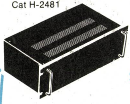
19" RACK MOUNTING CASE

Quality black instrument case suits 19" racks. Measures 42.5x25x14cm. Supplied flat.. takes only a few moments to assemble. Features heavy-gauge (3mm) front panel. Top and bottom are pre-punched for ventilation.
Cat H-2481

SAVE $ 10.00

JUST

$39⁹⁵



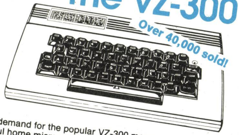
DICK SMITH ELECTRONICS
PTY LTD

PRE 'CATALOGUE RELEASE'

COMPUTERS

For every need & budget... as close as your nearest DSE store!

Yes!! A real computer for under $100... The VZ-300


Over 40,000 sold!

Sheer demand for the popular VZ-300 means we can offer this powerful home micro at such an unbelievable price! It's not a toy but a real computer offering full 18K RAM (expandable to 64K), 45-key keyboard PLUS colour, sound and graphics capabilities. The whole family will enjoy using it because of the brilliant array of software: personal finance, educational and games. If price has barred you in the past from joining the computer revolution, NOW there's no stopping you.

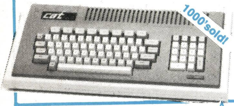
Cat X-7300

$99

The Cat Personal Colour Computer

DSE's popular CAT gives you more 'byte' from the proverbial Apple! Not only does it offer more memory (compare CAT's 32K ROM to Apple's 16K), it's Apple compatible — so you can run most Apple II series software. All that, and the CAT costs considerably less! CAT's impressive 64K RAM offers the serious home programmer a workable memory capacity and then some. The well layed out 81-key keyboard features numeric pad and 8 function keys capable of 24 software/programmable functions. On-screen colour (and sound) bring all your programs alive: brilliant 560 x 192 pixel grahics AND full 80-column text display. Includes inbuilt cassette, joystick and Centronics-type printer ports; Bus expansion interface, RS-232C serial adapter and more! The CAT is excellent value which will make any home programmer 'purr' with delight.

Cat X-7500



$499 *Talk to a DSE Expert about our updated range of software.*

• Monitor not included.

Powerful home computing that's affordable!

DSE Multitech is the alternative to the expensive IBM and clone brigade. A powerful 128K RAM, MS-DOS system with a host of impressive features... at a price that's not out of your reach! If specs impress you, then you'll certainly be impressed with Multitech:

- built-in 360K floppy disk drive
- real clock/calander with battery backup
- RS-232C serial inter-face, parallel printer, RGB monitor and joystick ports
- FREE IBM expansion slot
- 84-Key, ergonomically design key-board with numeric pad and 10 function keys.

The MS-DOS operating system is compatible with many of the world's most sought after programs PLUS you can run most IBM software straight from the box. Visit your nearest DSE store for a hands-on demonstration, today!

SYSTEM ONE
Cat X-8000
Now with 256K

$1395

DICK SMITH ELECTRONICS

See page 70 for address details

B.153F/RB

BARGAINS

HF LINEAR AMPLIFIER

A fantastic broad-band, Bi-linear amp that delivers up to 100W with only 4W input. Ideal for base and mobile use. Features 3-level RF power selection and over driving/voltage protection. Advanced semi-conductors, specially wound ferrite transformers operate from 2-30MHz without re-tuning. Covers entire HF freq. range. Output: 100W nominal, 180-250W PEP. Input/output impedance: 50 ohms nominal; SWR < 2:1 recommended. Cat D-2547

ONLY $499

'OSKERBLOC' VHF POWER/SWR METER

Spot on value for a handy meter that checks the accuracy/efficiency of your antenna and 2m VHF transceiver power ouput. It's by Oskerbloc - the world's most respected name in amateur circles. Cat Q-1341

ONLY $109

COMPONENT SELLOUT

DESCRIPTION	CAT No	WAS	NOW
Cap Electro Axial 35V 2200	R-4206	$1.95	$1.55
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Cap Green 100V 5PCT .22MFD	R-2110	.28	.22
Trimpot M'turn PC MT 19mm	R-1900	$2.60	$2.00
Cap Tant 35V .22 MFD	R-4705	.65	.50
Trimpot 5KR Vert 5mm 9M	R-1939	.40	.30
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Cap Ceramic H/Volt .01uF 3k	R-2400	$1.30	$1.00
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Pot-Wirewound 6mm 5W 5k ohm	R-6921	$5.50	$4.40
Cap Green 100V 5PCT .001MFD	R-2010	.25	.20
Pot-Carbon 6mm SG LIN 1M	R-6813	$1.05	.85
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Pot-Carbon 6mm SG LIN 50k	R-6809	$1.05	.85
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Pot Joystick 100k LIN B W/N	R-1976	$4.95	$3.95
Cap Green 630V 5PCT .1MFD	R-2170	.60	.48
Cap Electro RP 80V 2500MFD	R-4572	$4.80	$3.80
Cap Electro RG 40V 5600MFD	R-4570	$5.40	$4.30
Cap Green 630V 5PCT .22MFD	R-2172	.95	.75
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Cap Green 100V 5PCT 1.0MFD	R-2135	$1.25	$1.00
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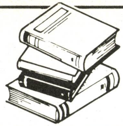
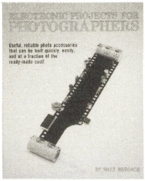



ELECTRONIC PROJECTS FOR
PHOTOGRAPHERS
Useful, reliable photo accessories that can be built quickly, easily, and at a fraction of the ready-made cost!
BY WALT BREGACH

Electronics for photographers

ELECTRONIC PROJECTS FOR PHOTOGRAPHERS by Walt Bregach. Published 1983 by Tab Books Inc. Soft covers, 187 x 234mm, illustrated with many diagrams and photos. ISBN 0-8306-1544-X. Retail price $24.95.

Here's an electronics text supposedly just for photographers. You may have seen most of the projects before — but not in one book. Chances are, the 'how to' approach of this book is better than most you've seen too.

The author assumes that the reader is a photographer, not an electronics hobbyist. The objective of the book is to allow said photographer to save some money by building his own accessories. The introduction states emphatically that the projects had to be really useful to qualify for the book and that each construction is explained fully.

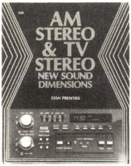
Certainly, the explanations are thorough. Introductory chapters deal with elementary electronics, safety and tools. For a book aimed at beginners in electronics, this is a commendable approach.

Seven projects are discussed in detail: Photographic Ringlight and Spotlight, Slave Trigger for Electronic Flash, Radio-operated Remote Control, Nickel-Cadmium Cell Rejuvenator, Darkroom Exposure Meter, Dual Purpose Darkroom Timer and a Digital Shutter Speed Tester. It's a good lineup worth a look. Our review copy came from Dick Smith Electronics. (C.R.D.)

AM stereo reference

AM STEREO & TV STEREO, New Sound Dimensions: by Stan Prentiss. Published 1985 by Tab Books Inc. Soft covers, 187 x 234mm, 184 pages. Illustrated with many diagrams and some photographs. ISBN 0-8306-1932-1. Recommended retail price $24.95.

This is the first book we have come across which presents a comprehensive treatment of AM stereo and stereo TV transmissions. As such, the coverage of AM stereo is entirely applicable to Australia while the chapters on TV stereo are applicable to the USA.

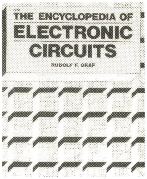


There are 10 chapters in all, five devoted to AM stereo and five to stereo TV. The first two chapters are essentially devoted to the history of AM stereo developments and the FCC marketplace decision. Included are descriptions of the Motorola and the now-defunct Belar system.

Chapter three is devoted to descriptions of the Kahn/Hazeltine and Harris systems with the note at the end of the chapter, that Harris changed over to the Motorola C-QUAM system on December 17, 1984.

Chapter four is devoted to AM stereo transmitter equipment while chapter five covers AM stereo receivers. It deals with necessary modifications to the Pioneer SX-6 and Technics SA-222 receivers for decoding the various systems. This chapter will be of particular interest to Australian readers, because it has plenty of practical information on the Motorola system.

Naturally, the chapters on stereo television have little or no interest to Australian readers but the book can be highly recommended as a reference on AM stereo. Our review copy came from McGill's Authorised Newsagency Pty Ltd, 187 Elizabeth St, Melbourne. Phone (03) 602 5566. (L.D.S.)



Large collection of electronic circuits

THE ENCYCLOPEDIA OF ELECTRONIC CIRCUITS by Rudolph F. Graf. Published 1985 by Tab Books Inc. Soft covers, 187 x 234mm, 760 pages. Mostly diagrams, little text. ISBN 0-8306-1938-0. Retail price $45.95.

Here is a vast collection of electronic circuits. In fact, there are more than 730 pages containing nearly 1300 circuits embracing almost every possible application. The circuits are grouped into no less than 98 different categories and all appear to use modern, readily available components.

All circuits have been reproduced from technical journals and semiconductor manufacturers' application literature. A 30-page listing at the back of the book acknowledges the source of every circuit.

Very little text accompanies most of the circuits and anyone who wanted more information would be able to obtain most of the original source materials via technical libraries or semiconductor manufacturers' representatives in Australia.

By the same token, there are instances where there are several circuits performing ostensibly the same function but the relative merits of each are not given. On this basis, the reader has to try it and see.

Between the covers there are a wealth of circuit ideas for the interested to peruse. The book will be a most useful source of circuits for experiment. We can recommend it. Our copy came from Dick Smith Electronics. (L.D.S.)

Revolutionary new memory

. . . fast access, non volatile and Australian owned

Just recently there have been reports of a revolutionary new memory system which is non-volatile, has extremely fast access times, low power operation and radiation hardness. And wonder of wonders, the process for this revolutionary memory is owned by an Australian company.

by COLIN DAWSON

Very shortly, dynamic RAMs with a capacity of one million bits will become available from companies such as Toshiba. More modest chips of 256 Kb are already available in very large quantities. With silicon technology at such an advanced state, why should anyone be bothered trying to develop an alternative?

The lure is a universal memory chip; a single chip capable of replacing the various types needed presently. For the first manufacturer to develop such a device, the potential market is enormous.

Rampac, a US-developed memory device, looks as though it could be the big breakthrough everybody has been waiting for. It combines all of the desirable features presently available from the three different types of silicon memory and has a big bonus because it is much less likely to malfunction when exposed to intense radiation. It is said to be "radiation hard" and therefore would have important applications in defence and satellite equipment.

At present, the choice of memory device depends on the importance of cost, speed, capacity and how long the data needs to be retained. Each type of memory chip has its own advantages and disadvantages.

The most common type of memory device is the DRAM (dynamic random access memory). These offer low cost and high capacity (up to 264K bits at present). They have the drawback that their stored contents have to be continually refreshed (or re-written). This adds to the complexity of the interface circuitry and increases the power consumption of the device.

Static RAMs don't need refresh circuitry but the capacity of a typical device is much less than for the same size DRAM chip. Both static and dynamic RAMs are volatile devices, meaning that they lose their stored contents as soon as they lose power. Where memory contents need to be held when power is removed, RAMs are often used in conjunction with battery backup circuitry.

Where memory contents have to be stored permanently, there are a range of ROM (read-only memory) devices such as the EAROM, EEPROM.

Rampac promises the best features of all the above memory devices and has a few other important advantages as well.

The new memory device relies on a property called ferroelectricity. Instead of being based on silicon, it uses a special phase of potassium nitrate (KNO_3) in thin film form. The film, only 0.01 microns thick, can be polarized with voltages of only 5V. This means the fabrication is compatible with existing electronic circuits, making it a practical alternative as a memory device.

Because of the ferroelectric property, each memory cell is given an electric polarity, once "written" into. The field remains intact until erased by the input of electrical energy, giving the memory its unique long term storage capability.

As each memory cell is nothing more than a tiny pad of the ferroelectric material, excellent density can be achieved. Rampac scientists are confident that 1Mb memories will be entirely practical. Further, the thin layers of potassium nitrate can be stacked on top of one another, suggesting the possibility of memories with up to 10Mb capacity.

The potential of ferroelectric materials in electronic memories has long been recognized. General Motors researched the concept heavily during the early 60's. Potassium nitrate was also their choice of material, but they were eventually forced to abandon the idea because it could not be made chemically stable.

A master's thesis, submitted by George Rohrer in 1970, described a process for stabilizing the thin film potassium nitrate. He formed a company called Technovation Corp. to develop memory ICs using the process.

Unfortunately for Rohrer, the mid-70s proved an inopportune time for the introduction of this new technology: silicon chip manufacturers were leap-frogging each other in the development of higher capacity memories and large scale integration. It is only recently that silicon development has begun to level out — it is thought that 1Mb memories are about the practical limit for silicon. This has led to renewed interest in ferroelectric memories.

In 1983, through American contacts, the Australian company Newtech became aware of Technovation Corp and the ferroelectric memory development. General Motors had also expressed interest in Technovation at about the same time but personal contact won the day and Newtech acquired control of the US corporation, beating General Motors to the punch.

Newtech have subsequently leased the rights for development and license of the ferroelectric memory to GM, having negotiated a 6% royalty contract.

Automobile manufacture is by no means GM's only industrial interest — through subsidiaries, they are also involved in aerospace and military supply. If developed successfully, the Rampac is expected to prove popular in both of these fields, as well as in various industrial control applications.

Perhaps more than any other field, automotive electronics would be revolutionised by the introduction of a robust, high capacity permanent memory.

It is likely that in the next decade or two, automobiles will become the largest users of electronic memories. Already, cars fitted with computerized spark control or fuel injection make use of electronic memories. This allows designers to program the optimum spark/injection settings for many different combinations of temperature, speed, load etc.

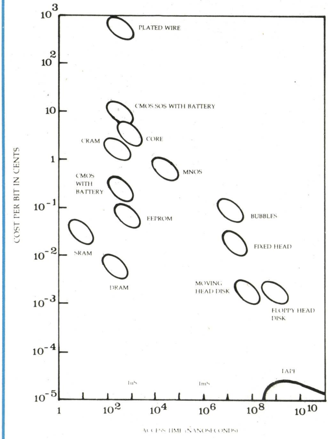
EPROMS must be used to store the information used in automatic controls, but it is likely that future generations of cars will need much more capacity than is available from EPROMS. One study has predicted an average capacity of 2Mb per car in the 1990's.

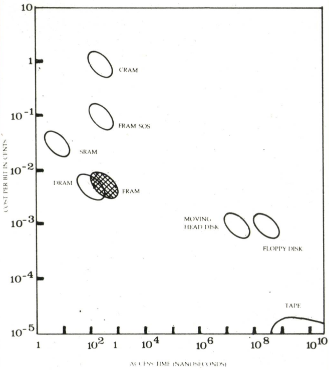
Most automobile manufacturers are already experimenting with exotic schemes such as satellite navigation. Although it is a relatively straightforward matter to get an accurate fix of position using satellites, processing this information in a useful way presents the greatest challenge.

Ideally, a navigation system would allow the driver to select a destination, and then give all the necessary directions to take him there. Such a system would require enormous memory capacity — in the order of megabits. Rampac would be ideally suited to this field. Each chip could be programmed as a zone map, the driver purchasing maps as necessary.

In terms of its capacity, the Rampac chip may prove a competitor to disc storage systems. It has the enormous advantage, of course, that it has no expensive and unreliable mechanical components. Clearly, a storage device with the speed and compact size of an IC and the capacity of a disc would be a very attractive proposition for many areas of industry.

The ferroelectric memory IC is still largely experimental. A preliminary production run of 1K chips has been made, but the higher capacities are still speculative. Judging by the amount of interest shown in Rampac, though, not only the company scientists are enthusiastic about its future.



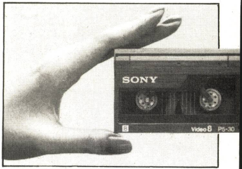


At left is a graph showing the comparative costs of memory at present while above is the likely distribution of memory devices and prices after the ferroelectric memories are introduced. Note that this is expected to cause the demise of many current non-volatile memories such as bubbles, core, plated wire and EEPROMs.

New format grows with release of new VCRs and camera/recorder

Sony goes all out on Video 8

With the assured success of Sony's first 8mm camera/recorder, the CCD-V8, they have released an impressive range of new products: the minuscule Handycam camera/recorder and companion portable VCR, and two conventional VCRs based on the 8mm format.



Not much larger than a conventional audio cassette but a little thicker, the 8mm video cassette is based on metal tape.

Sony has released its 8mm Handycam in Australia. This really small record-only camera-recorder has been available overseas in the NTSC version for some months but it is only now that a PAL version has become available in Australia. This new unit is significantly smaller than Sony's first 8mm product, the CCD-V8. It weighs a mere 1kg empty and 1.4kg with the 8mm cassette loaded and the battery in place.

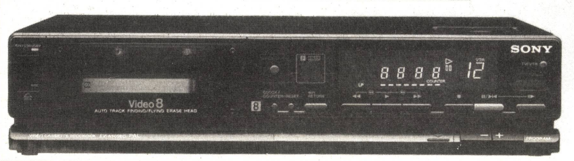
In size, the Handycam is not a great deal larger than the original Kodak "Box Brownie", with dimensions of 107mm wide, 109mm high and 215mm deep. The great reductions in size have been made possible by resorting to a simple lens system with three-position zone focussing (down to 1.2 metres), an optical viewfinder instead of the B&W CRT viewfinder of the CCD-V8 and the omission of playback facilities which greatly simplifies the overall circuitry.

The Handycam is fitted with an electret microphone, with foam windshield, and has a two-position white balance control, for artificial light and sunlight. Minimum illumination with the CCD camera is 25 lux and the system can be used in very bright sunlight with no danger of damage. Standard and long-play modes are available and the maximum recording time is three hours (in LP mode) although the rechargeable camera battery packs are limited to 80 minutes.

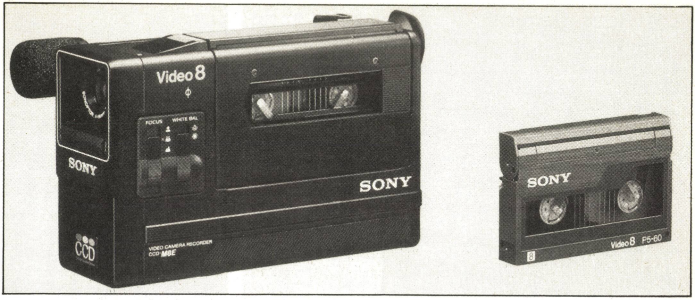
To accompany the Handycam, Sony has released three 8mm VCRs, one of which is a portable machine, the EV-C8, weighing only 1.1kg. This can operate from internal batteries or from external DC or mains supplies and can also be used with an optional tuner for off-air recording.

As a standard 8mm VCR, Sony have the EV-300AS which has all the functions of a conventional VHS or Beta format machine, including full infrared remote control, clean stills, frame-by-frame advance, and step slow functions, 3-week/4-event programmable timer, standard and long-play modes, auto playback and auto-return functions and a full coverage TV tuner. It also has a flying erase head for clean editing, hifi quality mono sound and can be used with a PCM adaptor for high quality sound recording.

As a deluxe VCR, Sony have the



The Sony EV-300AS is an 8mm VCR with all the standard features and infrared remote control.



Above is the Sony EV-700AS deluxe 8mm VCR which can record up to 18 hours of PCM stereo sound on one tape.

EV-700AS machine which has all the features of the EV-300AS as well as a 3-week/6-event audio/video programmable timer, double-speed playback and PCM stereo sound recording, in addition to the normal 8mm hifi standard mono sound track. The EV-700AS can also be used for sound-only PCM recording, in which case it can record up to 18 hours of high quality stereo sound.

And for those people who like the concept of Handycam but do not wish to buy an 8mm VCR because they already have a VHS or Beta machine, Sony has arranged for their dealers to transfer, at nominal cost, 8mm Handycam tapes to VHS or Beta format.

At this early stage of the game, 8mm equipment prices aren't cheap though. The Handycam CCD-M8 will sell for a suggested retail price of $1899 and the Pack-88, including CCD-M8 and EV-C8 VCR will sell for $2999. An optional tuner will be available for $499. The EV-300AS VCR will sell for $1199 and the deluxe EV-700AS will be priced at $1899.

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Electronics Australia reviews the . . .

Tektronix 2465 4-trace oscilloscope

The trend these days is towards increasingly complex oscilloscopes. As an example of this, we recently reviewed the Tektronix 2465 oscilloscope which is an up-market unit with comprehensive features and a price tag to match.

Reviewing the new Tektronix 2465 oscilloscope proved quite a challenge. Quite apart from specifications which exceeded much of our test equipment, the CRO has a bewildering array of controls and operating modes.

Even after close scrutiny of the operating manuals, mastery of the machine proved rather elusive; there seemed to be an ever increasing range of functions available. So just how difficult is the 2465 to use and does its performance justify the complexity?

First step in testing the machine was, of course, to switch it on and get a trace on the screen. An initially blank screen and various internal mechanical noises gave rise to some initial consternation but this, in fact, is all perfectly normal — the oscilloscope runs a self-diagnostic routine at switch on.

In the event of a failure in the CRO control logic, including the RAM and ROM, a failure code is displayed on the screen.

The on-screen display is capable of indicating much more than error codes. In fact, it indicates virtually the complete operating status of the machine. Timebase, volts/division, and delay time settings, along with a range of other data, can all be displayed.

Perhaps the most outstanding aspect of the display is the cursor function. By setting two on-screen cursors to any point on a displayed waveform, precise voltage, time, frequency and phase information can be obtained for display.

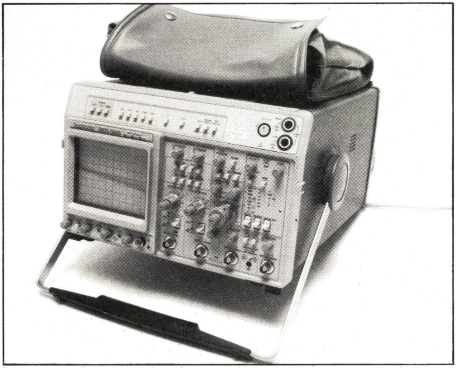
The review CRO came fully optioned with an IEEE interface, counter/timer, word recognizer and digital multimeter. Each of these functions is analysed during the self-diagnostic routine, and each can contribute to the on-screen display.

In passing, we might mention one particularly clever display mode. It is provided entirely for the benefit of photographing on-screen displays. While many CROs can be supplied with an accessory camera system, it is often a matter of trial and error to achieve a useful photograph.

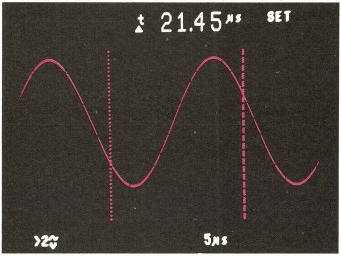
The 2465 has a feature whereby each of the four traces is displayed sequentially, followed by a brief display of the control settings and finally a two second illumination of the graticule. In this way, correctly exposed photographs can be made consistently.

Furthermore, the automatic operation of this feature means that it can be operated without supervision, simulating the operation of a storage CRO. Most impressive!

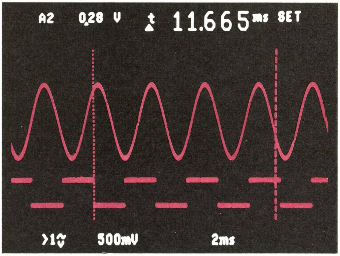
Most of the front panel controls are not 'hard wired' to the various circuits. Instead, they form the inputs for the control logic with the status of any con-



Many of the controls for the 2465 have more than one function. The digital multimeter controls are on the upper panel.



This photograph gives some idea of the on-screen display. More information can be displayed if required.



This display indicates that the CRO is in the delta t mode, with a time of 21.45μs between cursors.

trol indicated by LEDs. Provided that the self-diagnosis does not detect any faults, each control is set to the status used prior to switch off.

Hence the various internal noises heard at switch on; control relays are configuring the CRO to its last setting.

We found that sunlight entering through a skylight in our lab made the front panel LEDs difficult to see. The problem is due to the fact that the LEDs are viewed through a printed plastic screen which severely attenuates the light. As the LEDs are of no consequence once the operating mode is set, this is not likely to cause much inconvenience.

Many of the front panel controls perform more than one function. Indeed, one of the controls (delta t) is used for at least five different functions, depending on the mode. Generally, the on-screen display gives a reasonable account of the status, but a new operator would be wise to keep the manuals close at hand.

Elementary oscilloscope functions are quite easy to operate. It is only when the operator comes to the 'delta' (Dv, Dt) functions that any difficulty is likely to be encountered.

The delta controls relate to the positions of cursors (in most modes). The primary readings derived for the cursor positions (volts, time and frequency) all require that the timebase and volts/div controls are in the calibrated detents.

Should the operator make a Dt reading with the timebase control set to VAR (uncalibrated), the reading will indicate phase angle instead of time. Similarly, a Dv measurement with the voltage control set to VAR will change the reading from volts to percentage (of full scale).

The Dv or Dt modes are selected by pushing the appropriate button. Pushing both buttons at the same time puts the CRO into the 1/Dt or frequency mode. Here the distance between cursors gives rise to a frequency reading, if the timebase is calibrated. Setting the timebase to VAR leads to a reading of time percent.

For the cursor operation as described so far, the associated "Tracking" control must be set to "Independent". This allows the cursors to be moved independently. Alternatively, the Tracking can be made operative so that the cursors remain a fixed distance apart.

Adjustment of the delta controls will then move both cursors equally. This is a convenient feature for comparison of two waveforms not displayed at the same time.

The 2465 has the trigger delay features which we would naturally expect from a machine in this category. It includes A intensified by B, run after delay, trigger after delay and simple delay of the B trace. More complex control of the delay function can be achieved through use of the delta controls. They can be used to set up two intensified zones in each trace and vary their positions.

Selecting the mode of operation for the Counter/Timer/Trigger and Word Recognizer option is performed with the aid of an on-screen menu. When the Word Recognizer function is selected, a special data bus probe must be used — this is supplied with the option.

The Word Recognizer option can be configured to recognize any 17-bit word, including "don't care" bits. The particular word of interest can be subjected to timing or counting, or used to control the delay functions.

Where the General Purpose Interface Bus (GPIB) option is fitted, it can be used to control most of the oscilloscope functions, as well as interrogating the machine to retrieve data from either the digital multimeter or Counter/Timer/-Trigger facilities. This feature is a particularly specialised one, not likely to find much application outside of labs equipped with automatic testing facilities.

Time restrictions prevented us from testing all of the many operating modes and variations of the Tektronix 2465. In any case, we do not have the facilities to properly test the Word Recognizer and IEEE interface features.

All of the features we tested performed impeccably — once we managed to achieve the necessary set up. In fairness to the machine, it is somewhat more complicated than our customary test equipment. Undoubtedly, the many subtleties of its operation would become more apparent with practice.

Even the base 2465 oscilloscope, without options, can fairly be described as a test lab in a box. Fully optioned, it is an extraordinarily sophisticated machine capable of a diverse and powerful range of test roles.

Although the expression "professional" is much abused with respect to test equipment, we have no qualms about classifying the 2465 as a piece of "professional gear". The many controls and modes of operation would most likely prove a hindrance outside of a test lab, and the price tag clearly puts it outside of the amateur field. It is a most impressive piece of equipment.

For further information contact Tektronix Australia Pty Ltd, 80 Waterloo Road, North Ryde, NSW 2113. Telephone: (02) 888 7066. (C.R.D.)

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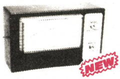

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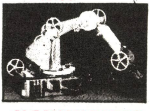

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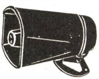

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PART 7

How to service cassette decks

Cassette decks suffer from mechanical wear and require regular cleaning and parts replacement to operate correctly. You can either pay out big bucks to a professional serviceman or do the job yourself.

by KINGSLEY HOWE

Over the last ten years or so, great advances have been made in the musical reproduction from cassette players and tapes. But many owners are not deriving the full benefits. The mechanical complexity and compact nature of the cassette deck, and the fine tolerances involved, render it far more liable to faults than a record player in the same environment. In particular, attention is required to keep the deck free from dust and fluff, and to keep the heads clean.

Owner instruction manuals invariably list the voltage ranges on which the player will operate, and detail the control functions and external connections. But very few manufacturers include cleaning instructions. As a result, many owners become disappointed with the sound quality. There are other factors of course, such as normal wear and tear, but these problems do not normally occur until after several years of use.

User Care and Maintenance

Keeping the deck free of dust and fluff is important, as this can cause both mechanical and head wear. Good quality reproduction from the head is only possible if it is cleaned regularly

For best performance, the recommended period between cleaning is about every ten tapes, or say twenty sides of play. Heads are best cleaned with a cotton bud dipped in methylated spirits. Rub the tip over the face of the head, until the tip becomes brown with oxides. This done, turn the bud around and use the other end as well. If all the oxide has been removed, this end will remain white. Should this not be the case, further cleaning will be needed.

The erase head may also need treatment, although these are not so prone to oxide contamination as are the record-play heads.

After cleaning both heads, wipe up any oxide that may have fallen under them with a cotton bud. The deck should also be wiped with a soft cloth to remove any dust, etc.

The pinch roller should be tackled next. This should be turned by hand and cleaned a section at a time, again using a cotton bud and methylated spirits. At first the oxide will be hard to remove, but this softens after a while and may be removed with further rubbing.

The heads on some decks may be difficult to reach, as they may retract back into the casing when the 'stop' button is pushed. In this case, depress the play button with power to the unit switched off. The head should slide out over the deck plate, for cleaning.

Note that this method cannot be used on microprocessor-controlled decks, (soft touch), or those with carrier trays fitted to the lids. The slot loading types may also present problems, as the head moves well away from the playing area, when the cassette is not in place. If the head is visible, but out of reach with the standard medical cotton buds, try the extra long types sold by Tandy stores for this purpose.

In extreme cases, the cabinet may have to be removed to reach the heads. Head cleaning tapes may be used to advantage on light deposits, however they only contact a small part of the head and will not clean the pinch roller. Some are also quite abrasive and overuse may ruin the head entirely.

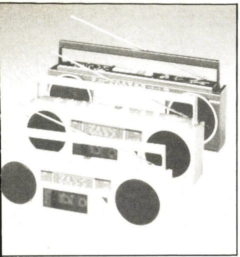
When the cleaning tape does not produce the desired result, manual cleaning is a must.

Testing the head

After the head and pinch roller are completely dry, try playing a tape. With the oxide removed, more treble should be heard and the volume should be higher than for previous playings. If this does not happen, check the head for wear. Using a torch, examine the face for a groove cut by the tape, or a stippled surface. In each case, excessive wear is indicated and the head should be changed before it begins to damage tapes.

On close inspection, some stubborn spots of oxide may be seen. Do not use a metal tool to scrape this off. Even a slight scratch on the face will ruin the head. Use a wooden match or toothpick and light pressure.

To faithfully reproduce a recording, the cassette tape must sit tightly against



the head face. Any uneven, worn, or grooved areas, will hold the tape away from the sensitive gap, which detects the magnetic field from the tape coating. Under such conditions, the bass and mid-frequencies may be heard, but little or no treble at all.

Badly worn or creased tapes may cause the same symptoms. The wear from a faulty head is mainly confined to the oxide coating. A little of the surface is scraped off each time the tape is played, and subsequent replays become more and more muffled. The wear can be seen on the tape as shiny strips along the entire length.

Creased tape is often an indication of a pinch roller defect. If the pinch roller does not wear evenly, it may become lumpy or out of round. With the high pressures involved between the drive spindle and the pinch roller face, any lumps will impress themselves into the tape and leave a form of dimple at regular intervals. Creases can be the result of an out of round roller pulling the tape up and down against the spindle. If this is the case, the pinch roller should be replaced.

In both cases above, the tape will tend to make intermittent contact at the sensitive gap on the head. The result ranges from varying volume in mild cases to complete "dropout" in severe cases. Dropout in this sense means sections of the music missing completely when a crease passes over the head gap.

On odd occasions, a lump of oxide or a ball of accumulated fluff may attach itself to the pinch roller, and the pattern of this presses into the tape at each revolution.

Provided the pinch roller is in good condition but is tending to slip, it may be 'dressed' to remove the glaze or shine from its surface, and improve the grip. In cases where the mechanical automatic stop fails to trip out, this may effect a cure.

Tear off a small piece of very fine emery paper, about the size of a postage stamp. With the unit switched on, press the play button. Hold the emery against the pinch roller face. Apply only light pressure at first, as the roller will begin to slip or perhaps stop rotating. Gradually increase the pressure as you feel the grip increase.

When finished, the roller face should be black and dull, and some grit and fine rubber dust may be left on it. Clean this off with a cotton bud and methylated spirits while the roller is turning. Keep the cotton tip away from the spindle, as it may become wound around it. If the cotton does get caught, press the "stop" button, then carefully unwind it.

When the roller is dry and free from dust, insert an old cassette, and try the automatic stop for correct operation. This should work immediately but, if not, the rubber drive belt on the motor may be slipping.

To determine whether a cassette deck has a mechanical automatic shutoff fitted, look between the erase head and the record-play head. A small white finger will be mounted there. When the "play" button is pushed, this will feed out further than the heads. Absence of this finger means that the deck is fitted with an optical or magnetically operated electronic trip. On these decks, the pinch roller plays no part in the automatic shutoff action.

The foregoing section covers most of the work that can be done without dismantling the whole unit. Most owners should be able to carry out the above procedures without difficulty.

Parts replacement

The following information will enable most cassette decks to be disassembled without a great deal of trouble so they can be repaired. There are probably several hundred different types in use, but some faults are common to most brands.

Cassette players can be divided into two broad categories: mains types only, and mains-battery powered portables.

Virtually all portable cassette players are housed in a plastic case in combination with a radio. To gain access to the interior, the two halves of the case must be taken apart. This may seem to be a straightforward operation, but remember that the case is of plastic construction and may be easily damaged. The following procedure should cover most models:

You will need a towel or thick cloth, a cardboard box, and a set of Philips head screwdrivers. Lay the cassette down on its face, open the battery compartment and remove any batteries. The screws holding the back cover can then be removed. Note that the screws may be of several different lengths. Carefully note the location of each.

If a screw is subsequently fitted to the wrong position on re-assembly, attempts to tighten it may strip the thread from the plastic pillar. Some models may even contain a mixture of self-tapping and metal thread screws.

After all the screws have been removed from the back cover, check for additional screws inside the battery compartment. The back should now be ready to remove. It should be fairly loose at this stage. If not, there may be other screws at either end or concealed from view.

A few models are the reverse of normal in that they have the circuit boards and deck attached to the rear half of the case. These may require that all knobs be detached from the front or top before the two halves can be parted. On some decks, a screw may be found in the centre of the deck plate.

If the rear of the case still catches, push the eject button to open the cassette lid.

Larger stereo portables, owing to their length, may have plastic tongues moulded at the join to prevent the case from warping. These can require a fair amount of force to open, as the tongues lock the case together firmly. They will usually open with a loud crack as the tongues disengage.

It is not advisable to use a knife blade or screwdrivers to pry the two halves

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apart, as this can damage the case.

When the case does come apart, keep the two halves adjacent to each other until further checks can be made. Invariably, leads from the antenna or from the battery terminals in the back half of the case will be attached to the main board in the other half of the case. These will either be fitted with plugs or soldered on. Note their positions before removing them.

Lay the rest of the unit down with a towel under it to prevent scratching. have a good look at the layout of the interior. You will have to re-assemble it later, so make sure you are familiar with the position of cables, plates, brackets and PC boards. Clean out any dust, fluff, spider webs, dead moths etc.

There is nothing more annoying than to find, after the whole unit is assembled, that a moth has lodged in the radio dial window, and the lot must be taken apart again to get it out.

You are now faced with a large number of screws. Which ones to take out? Which ones to leave in? Be careful. Some of these screws hold several mechanical parts, and removing one may release a part which is difficult to restore unless the whole deck is stripped down.

Fortunately, most manufacturers colour main mounting screwheads pink. Tackle these first. If only plain uncoloured screws are seen, check under the deck and main board for plastic pillars.

The rear of the cassette deck should now be exposed to view, and removal of this can be treated in the same way as the board. Note that the "eject" button may have to be pressed to release the deck. Also, some cables attached to it may be anchored at various points by means of metal tabs or wire ties. Free the cable from them before turning the deck over completely.

"I got it! I got it!"

A piece of cardboard may be slipped under the deck at this stage to prevent damage to the deck or anything underneath. Corrugated board from supermarket cartons is suitable for this purpose. Note that any parts removed should be placed in a small box to prevent loss, along with any notes or diagrams you will have made.

On some models, particularly the later ones, the deck cables are terminated with multipin plugs, and these decks may be completely removed.

You will now have to determine which parts need replacing. Wear on heads and pinch rollers is fairly obvious on inspection. The bolts may be worn and stretched, and the motor may be near the end of its useful life.

Before ordering any parts, note the make and model number of the unit and include the serial number as well. The reason for this is that design changes are sometimes made during a production run, and parts may differ from a certain serial number onwards. Copy down any coding on motor labels or heads to avoid the supply of incorrect parts, if you are dealing with the manufacturer's agent.

Fortunately, there are general purpose motors and heads that will suit many models. If you are not buying from the local agent, remember to take the motor, head or belts with you. The retailer will need them as a guide; vague descriptions are no help.

Mains-powered decks

Most of the previous information on portable cassette players applies to nonportable decks as well. There are a few additional points that should be noted, however.

First, the motors in some older decks run on AC and are fan cooled. The fan is generally located on an extension of the motor shaft, and may be bent or broken unless kept clear of the work bench.

Second, the cassette door on some front-loading decks may have to be removed before the cassette deck can be removed from the chassis. Some have a cover which will slide off, while others require the removal of screws.

Finally, European decks may have screws in some very unusual places. You may have to look under decoration plates for screws, or some may be hidden by push-in plastic caps.

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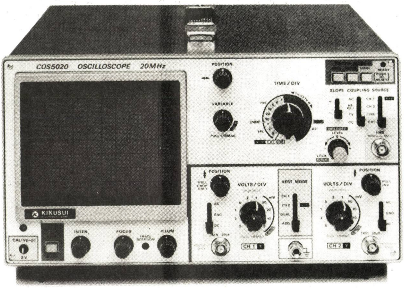

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WHEN GEOFF DOES A KIT HE DOES IT PROPERLY

Geoff's policy is to do a few kits and do them well. Rather than bundle up bits and pieces for everything under the sun, Geoff takes a lot of trouble to get all the RIGHT parts for just a few projects. As a result you can be assured that there are no dubious substitutions and that all parts are prime spec.

Also the projects are checked out before the kit is even considered. Both of this month's projects had mistakes in the original articles - in both cases the PCB layout was incorrect - and Geoff was the one who spotted the errors.

AEM4600 DUAL SPEED MODEM

Geoff can't put this kit together fast enough. The queue started to form the moment the magazine came out.

Features both 300/300 baud full duplex and 1200/75 baud half duplex operation so it's ideal for Viatel. All functions are selected with quality C&K toggle switches with four LEDs to indicate correct functioning. Interfacing is standard RS232 using a minimum of signal lines for "universal" interfacing.

Geoff's kit comes complete with punched front panel (looks like a bought one!) and is just **$159.00**

ETI 169 LOW DISTORTION OSCILLATOR

If you're checking out Hi Fi systems then an audio oscillator is a must. The trouble is that the average el-cheapo probably has a higher level of distortion than a $10 transistor radio. So with this kit there can be NO compromises. The distortion just has to be better than 0.001%. Covers the frequency range to 100kHz. Geoff has checked the whole thing through with Ian Thomas (including pointing out the track error on the pcb).

Kit again includes a posh front panel and the top quality AB pot (available separately at **$9.00**).

Complete kit **$179.00**

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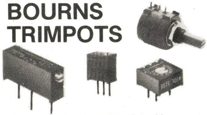

Continuing Geoff's policy of stocking only the highest quality components we have now added a range of Bourns trim pots. The PC board mounted types are available in three styles and many values are available ex-stock. Call us for full details, pricing etc.

3006 RECTANGULAR MULTITURN POTENTIOMETER

Industrial grade, high quality with 15 turns adjustment. Resistance range from 10ohms to 2Mohms. Adjusts to 0.01% of range. 0.75W rating. Measures 0.75" x 0.19" x 0.25" high.

3299 SQUARE MULTITURN POTENTIOMETER

High quality, industrial grade with 25 turns adjustment. Resistance range from 10ohms to 5Mohms. Adjusts to 0.01% of range. 0.5W rating. Measures 3/8" square and 1/4" thick.

3386 SQUARE SINGLE-TURN POTENTIOMETER

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New Products...

Product reviews, releases & services

Scanspeak 300 loudspeaker system

Following the success of the Scanspeak 200 loudspeaker system, Scan Audio Pty Ltd have released a much larger three-way system, the Scanspeak 300. This comprises a rugged 25cm woofer, a 13cm cone-type midrange driver and a 20mm dome ferrofluid-cooled tweeter in a large time-aligned vented enclosure.

Having recognised the demand for a larger three-way system, Audio Scan have commissioned this impressive new design. It is an imposing system, standing just over one metre high, 36cm wide and 31.5cm deep. The front baffle is stepped back so that the tweeter and midrange voice coils are approximately lined up with that of the woofer.

This achieves time-alignment or phase-alignment of the drivers so that the acoustic waveforms reproduced by the system are not distorted due to phase differences from the three drivers. The baffle is also fitted with specially profiled foam blocks which are intended to reduce or eliminate any unwanted diffraction effects due to the shape of the enclosure.

The enclosure itself is designed according to Thiele-Small principles (all Scanspeak low and midrange drivers are characterised with Thiele-Small parameters) and is tuned to give a smooth and extended bass response down to below 40Hz.

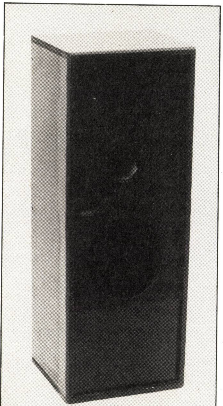
As with the Scanspeak 200 model, the enclosure is not finished in timber veneer but is sprayed black and fitted with a Jersey fabric skirt which functions as grille cloth and surface finish. The top surface of the enclosure is a veneered timber panel.

The crossover network is most impressive and uses large metallised polypropylene capacitors together with ferrite and air-cored inductors. Bipolar electrolytics have not been used, to avoid any possibility of distortion from this source. The resulting attenuation slopes are 12dB/octave beyond the 3dB corner frequencies and the nominal crossover frequencies are 750Hz from woofer to midrange and 3kHz from midrange to tweeter.

Being large and bulky, the crossover components are secured to a substantial printed circuit board by means of epoxy adhesive.

As a matter of interest, Scanspeak drivers are used in quite a few well-known and respected loudspeaker systems from England and Europe. They have gained an enviable reputation for performance.

Power handling of the complete system is generous. The woofer has a rated power of 120 watts and a ten millisecond pulse power of 600 watts. The ratings for the tweeter and midrange are in the same ball-park too, for their in-



The kit includes a large time-aligned enclosure, a 25cm woofer, a 13cm cone-type midrange driver and a 20mm dome tweeter.

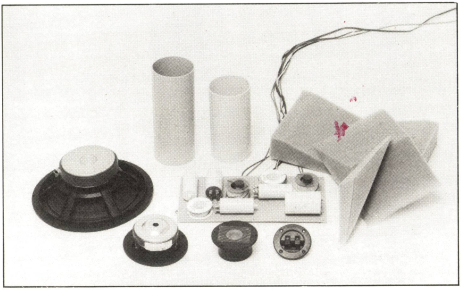
Using the special pen supplied it is easy to write on and rub off these adhesive labels as the recorded programs change. The recommended retail price is $4.99, and the pack contains 10 gridded 'write and wipe' labels with tape running times and a pigment pen.

For further information, contact Dupla Erasable Label Systems, PO Box 91, Surry Hills, 2010. Phone (02) 699 3228.

tended frequency range. The tweeter's power handling is exceptional in this regard due to the ferrofluid in the voice coil gap. Nominal impedance of the completed system is 8Ω.

For those interested in this system, it can be demonstrated in selected hifi stores in the major cities. The drivers, and major components can be purchased separately, as can the enclosures in knock-down form. Alternatively, we understand that the system will be available in fully assembled form. Price of the complete kit for a pair of Scanspeak 300s is $1616.00.

For further information, contact Scan Audio Pty Ltd, 52 Crown St, Richmond, 3121. Phone (03) 421 2199.



The crossover network uses large metallised polypropylene capacitors.

Viatel compatible minimodem

Avtek has recently released a minimodem with a number of features for under $200. The Mini Modem supports supports both 30/300 and 1200/75 baud rates catering for database and Viatel. By using digital filters the reliability of the modem on bad lines has been enhanced. This becomes important with the increasing use of Viatel for banking transactions.

Avtek are currently supporting Viatel software for Microbee, Commodore, Apple and most MS-DOS machines.

For further information, contact Avtek Electronics, 25 Burns Bay Road, Lane Cove. Telephone: (02) 427 6688.

New insulators eliminate thermal grease

These new thermal insulators eliminate both the mess of thermal grease and the cold-flow of elastomeric insulators.

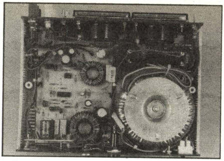
The product is known as Crayotherm and consists of a special thermally-conductive polyimide film that is flexible, tough, and stable. On each side of the film is a thin coating of a new thermal compound which is a solid at room temperature.

After installation, semiconductor operating temperatures melt the "change-of-state" compound so that it wets the semiconductor and the heatsink, forming a good thermal joint. The compound returns to the solid state when the equipment is turned off.

The insulators contain no silicone or silicone grease and eliminate a high proportion of the short circuits due to cut-through.

For further information contact Orcus, Box 16022, Kansas City, Missouri 64112, USA.

New cases for EA projects



Two of EA's most popular projects have been the Musicolour IV described in August 1981 and the 50V/5A Power Supply described in May and June 1983, and subsequently updated in May 1985. Both kits are still selling well, despite the time that has elapsed since publication.

With this in mind, Altronics Pty Ltd has just re-released both kits with plastic instrument cases instead of the original metal cabinets. Although slightly smaller than the metal cabinets, the new plastic cases look much better.

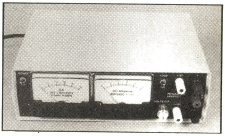
To fit into the smaller boxes, both projects have been made more compact. For the power supply, this was made possible by using a low profile toroidal transformer. In fact, the transformer is such a neat fit it looks as though it was designed just for the box.

The Musicolour needed a new front panel layout. This will be silk screened onto the box, as will the front panel for the power supply.

A metal baseplate is supplied with both kits. Although this provides mechanical strength, its most important role is to supply an effective earth for the mains. This is a vital safety aspect for a circuit switching the mains such as the Musicolour.

We have tested both projects and found them to work as well as the originals. Current prices are $99.00 for the Musicolour IV and $149.50 for the 50V/5A Power Supply.

For further information, contact Altronics Pty Ltd, PO Box 8280, Stirling St, Perth 6000, WA.



KEF

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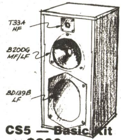
CS3 — Basic Kit
$225 each

This very high quality bookshelf loudspeaker is based on the KEF MODEL 103.2. utilising the same drive units.

It is a two-way system specially designed for the home constructor.

The drive unit compliment comprises a 200mm Bextrene cone LF unit and a 25mm HF dome radiator.

Model CS3 is capable of very high quality performance and can out-perform some of the best loudspeakers available.

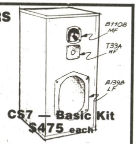


CS5 — Basic Kit
$300 each

This floor-standing loudspeaker has an extended low-frequency performance and provides remarkable sharp stereo imaging.

It features a 200mm diameter Bextrene cone LF drive unit with a passive bass radiator and a 25mm dome HF radiator.

Model CS5 will reproduce the full frequency range available from the best modern recordings with outstanding clarity and low distortion.



CS7 — Basic Kit
$475 each

This is a full three-way loudspeaker system employing the KEF B 139 which is the world's most famous bass driver fitted with a flat diaphragm originally developed by KEF over 20 years ago. The mid-range unit features a Bextrene cone diaphragm and PVC roll surround. High frequencies are handled by a 25mm dome radiator. This remarkable system has an extended bass response and excellent power handling capacity. The computer designed crossover network gives a very smooth frequency response characteristic and ensures finely detailed reproduction of critical mid-range information.

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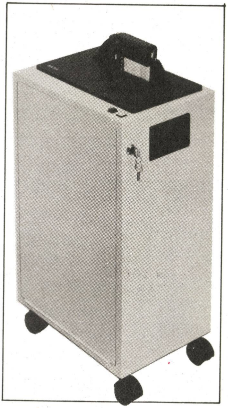

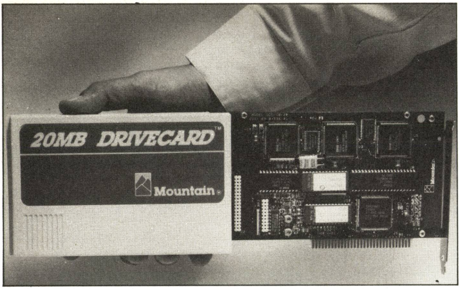

Hard disk expansion for IBM PCs

The "Mountain Drivecard", a complete hard disk system for IBM PCs and most compatibles, has recently been released by Logo Computers.

The system provides 20 megabytes of storage and a plug-in card utilising the latest CMOS VLSI gate array technology to reduce the component count.

Power consumption of the drive card is 14W and it comes with a 12-month warranty and a set of utility programs.

For further information, contact Logo Computer Centre, 305 Henry Lawson Business Centre, Birkenhead Point, Drummoyne, 2047. Telephone: (02) 819 6811

tape erasers from RME

Sanix bulk tape erasers are used in broadcasting stations and production houses in Japan and are now available in Australia. There are three versions. The Series 1000 is intended for high coercivity 1-inch open reel tapes and gives erasure of better than −70dB at 80Hz. Designed for continuous automatic operation, it can erase up to 60 tapes per hour.

The Series 2000 is intended for all types of open-reel tapes while the Series 3000 is intended for all video-cassette tapes such as U-matic, VHS and Beta.

For further information, contact Radio Manufacturing Engineers Pty Ltd, PO Box 259, Auburn 2144. Phone (02) 648 2531.

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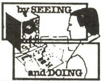

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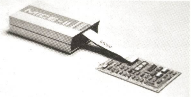

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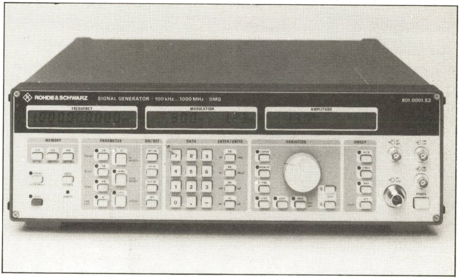
New Products...

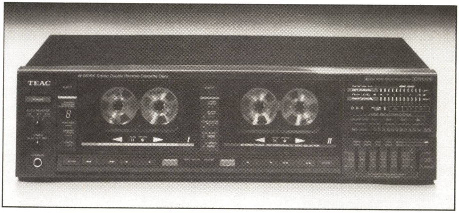


1GHz signal generator from Rohde & Schwarz

Rohde & Schwarz have released the SMG Signal Generator which is a fully synthesised low-noise signal source for use in all fields of electronics. It offers spectral purity and crystal-referenced signals in the range from 0.1 to 1000MHz with 1Hz resolution and with an output level adjustable between −137 and +13dBm in steps of 0.1dB.

The SMG Signal Generator offers AM, FM, unmodulated pulse and FSK modulation. For two tone modulation, internal and external sources can be switched in simultaneously. Since all functions are remote-controllable via the IEEE-4888 bus, the SMG can be used in both manual test assemblies and optimally in automatic test systems.

For further information, contact Rohde & Schwarz Australia, 13-15 Wentworth Avenue, Darlinghurst, 2010. Telephone: (02) 267 2622.



Double reverse cassette deck

Teac has recently released a new dual tape deck, the W-880RX. It features auto reverse recording and playback, continuous playback of two tapes and continuous playback of selections. The W-880RX incorporates dbx and Dolby B and C noise reduction, plus the ability to copy tapes without noise reduction for playback in car and personal portable cassette players.

A five band graphic equaliser with AFS (Automatic Frequency Shift) shifts the frequency settings to high position automatically during high speed dubbing.

For further information contact Teac Australia Pty Ltd, 115 Whiteman Street, South Melbourne, 3205. Telephone: (03) 699 6000.

High humidity switching sensor

IRH Components have released a new high humidity switching sensor, type HOS201, which is a variable resistance element. The HOS201 has an operating voltage of 1VAC maximum 50Hz with an operating temperature range of 0°C to +50°C. At a relative humidity of 75% RH the resistive element drops from a very high resistance value to less than 1MΩ. The sensors can be used in a wide variety of applications including air conditioners, instrumentation and humidity limiters.

For further information, contact IRH Components, 32 Parramatta Road, Lidcombe, 2141. Telephone: (02) 648 5455.

Broadband power amplifiers from Scientific Devices

Scientific Devices Pty Ltd have been appointed as Australian representative for E.N.I. Inc (Electronic Navigation Industries) who manufacture a range of solid estate RF power amplifiers.

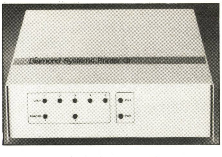
These are used in such areas as communication, transmission, NMR spectroscopy, EMI susceptibility, laser modulation and general laboratory instrumentation.

Scientific Devices Australia Pty Ltd, 2 Jacks Rd, South Oakleigh, 3167. Telephone (03) 579 3622.

New 18V solar panel from Altronics

Altronics of Perth have a new 18V solar panel at the attractive price of $89.95. Measuring 425 x 385mm, it consists of 35 cells wired together in series to give a 7W output at 18V nominal. All the cells are soldered to a heavy phenolic printed circuit board, vacuum packed with a protective clear plastic sheet and rivetted to a stainless steel frame and backing plate.

Altronics have donated one of the panels as a prize for a reader with the best and most original circuit application for the panel. See the "Circuit & Design Ideas" pages in this issue.



Printer switcher from Diamond Systems

Diamond Systems has released the Printer Qr, an intelligent interface for up to five computers and two printers. It combines the functions of buffer and intelligent switch.

The buffer can be up to 512K and is allocated dynamically to each user, depending on need and is combined with character compression for efficient use of memory.

Software commands at the start of a document can be used to perform multiple copies, reset user data or direct output to a particular printer.

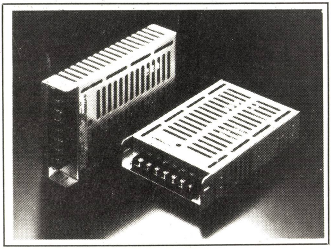
Further information is available from Diamond Systems, PO Box 105, Hurstbridge 3099. Phone (03) 714 8269.

DC-DC CONVERTERS

29 MODELS AVAILABLE OFF THE SHELF,
DC INPUT SWITCH MODE POWER SUPPLIES.

FEATURES:

- Input – Output isolation
- Floating input and output voltage allows either polarity
- Input voltages: 12V (9.2-16V range)
  24V (19-32V range)
  48V (38-63V range)
- Output Voltages: 5, 12, 15, 24 VDC in either polarity in single, dual or triple configuration
- Output power: 12.5, 15, 40, or 50 watt
- Short circuit protection
- Over voltage protection
- High efficiency switch mode
- Dimensions: 118 × 80 × 25 and 160 × 96 × 33 mm
- Lightweight: 250 and 420 mg
- Enclosed box for shielding and easy mounting



AMTEX
ELECTRONICS

A DIVISION OF TLE ELECTRICAL PTY LIMITED
(Incorporated in New South Wales)
36 LISBON STREET FAIRFIELD,
NSW 2165 AUSTRALIA

TELEPHONE (02) 728 2121, 727 5444
TELEX AA27922 ATTN AMTEX
FACSIMILE (02) 728 2837

Check our test equipment range!

FREE FREIGHT ANYWHERE IN AUSTRALIA DURING APRIL!
12 months warranty!
Includes two free probes!

HUNG CHANG (RITRON) 20 MHz DUAL TRACE OSCILLOSCOPE

- ***Wide bandwidth and high sensitivity***
- ***Internal graticule rectangular bright CRT***
- ***Built in component tester***
- ***Front panel trace rotater***
- ***TV video sync filter***
- ***Z axis (Intensity modulation)***
- ***High sensitivity X-Y mode***
- ***Very low power consumption***
- ***Regulated power supply circuit***

COMPONENT TESTER is the special circuit with which a single component or components in circuit can be easily tested. The display shows faults of components, size of a component value, and characteristics of components. This feature is ideal to troubleshoot solid state circuits and components with no circuit power. Testing signal (AC Max 2 mA) is supplied from the COMPONENT TEST IN terminal and the result of the test is fed back to the scope through the same test lead wire at the same time.

CRT

CRT: *6" (150mm) Flat-faced high brightness CRT with Internal Graticule.*
Effective display area: *8 x 10 div (1 div = 10 mm)*
Acceleration potential: *2KV*

VERTICAL

Operating Modes: *CH-A, CH-B, DUAL, ADD (CH-B can be inverted.)*
Dual modes: Alter; 0.2ufs - 0.5ms/div. Chop; 1ms - 0.5s/div.
CHOP frequency 200KHz approximately.
Deflection factor: *5mV/div 20V/div +/−3%, 12 ranges in 1-2-5 step with fine control.*
Bandwidth: *DC; DC - 20MHz (−3dB). AC; 10Hz - 20MHz −3dB).*
Rise Time: *Less than 17ns.*
Overshoot: *Less than 3%.*
Input Impedance: *1M ohm +/−5%, 20pF +/−3pF*
Maximum Input Voltage: *600Vp-p or 300V (DC+AC Peak).*
Channel Isolation: *Better than 60 dB at 1KHz.*

HORIZONTAL

Sweep Modes: *NORMAL, and AUTO*
Time Base: *0.2ufs - 0.5s/div +/−3%. 20 ranges in 1-2-5 step with fine control.*
Sweep Magnifier: *5 times (5X MAG).*
Linearity: *3%.*

TRIGGERING

Sensitivity: *INTERNAL: 1 div or better for 20Hz - 20MHz (Triggerable to more than 30MHz). EXTERNAL: 1Vp-p or better for DC - 20MHz (Triggerable to more than 30MHz).*
Source: *INT, CH-A, CH-B, LINE and EXT.*
Slope: *Positive and Negative, continuosly variable with level control PULL AUTO for free-run.*
Coupling:*AC, HF-REJ and TV. TV SYNC Vertical and Horizontal Sync Separator Circuitry allows any portion of complex TV video waveform to be synchronized and expanded for viewing TV-H (Line) and TV-V (Frame) are switched automatically by SWEEP TIME/DIV switch.*
TV-V:0.5s/div to 0.1ms/div. TV-H:50ufs/div to 0.2ufs/div.

X-Y OPERATIONS

X-Y Operations: CH-A: *Y axis. CH-B: X axis Highest Sensitivity: 5mV/div.*

COMPONENT TESTER

Component Tester: *Max AC 9V at the terminal with no load. Max current 2mA when the terminal is shorted. (Internal resistance is 4.7K ohm)*

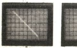
OTHER SPECIFICATIONS

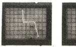
Intensity Modulation: *TTL LEVEL (3Vp-p); Positive ...... brighter.*
BANDWIDTH; DC - 1MHz MAXIMUM INPUT VOLTAGE: 50V (DC+AC Peak)
Calibration Voltage: *0.5Vp-p +/−5%, 1KHz +/−5% Square wave.*
Trace Rotation:*Electrically adjustable on the front panel.*
Power Requirements: *AC; 100, 120, 220, 240V 20W*
Weight: *7kg approximately.*
Size: *162(H) x 294(W) x 352(D)mm.*

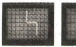
Cat. Q12105 .... ***only $695***

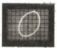
(tax exempt only $595)

Bulk orders, schools, please phone (03) 543 2166 for special low pricing


Resistor


Zenon Diode

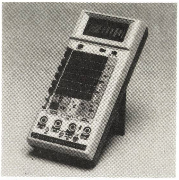

Digital Circecuit


Capacitor

605 3½ DIGIT MULTIMETER

New replacement for YF1100. See specification tables below for details.

Cat. Q11035 .... **$79.95**



705A 3½ DIGIT MULTI/CAPACITANCE METER

See specification table below for details.

Cat. Q11040 .... **$119**

605 & 705A SPECIFICATIONS

Capacitance

Range	Resolution	Accuracy 605	Accuracy 705A	Test Signal	Max. Input
2nF	1pF	NC	3.5%+4	400mV rms	3V DC/peak AC on all ranges
20nF	10pF			512 Hz 40mV rms	
200nF	100pF				
2000nF	1nF				
20µF	10nF				

AC Current

Range	Resolution	Accuracy (50-500 Hz) 605	Accuracy (50-500 Hz) 705A	Burden Voltage	Overload Protection
200µA	100nA	NC	1.2% -4	0.3V max	705A: 0.2A fuse up to 250V. 605 : 2A fuse up to 250V 10A range not fused
2mA	1µA	1.2%+4			
20mA	10µA				
200mA	100µA				
2000mA	1mA	2%+4	NC		
10A	10mA	1.5%+4	1.5%+4	0.7V max	

Resistance

Range	Resolution	Accuracy (Hi) 605	Accuracy (Hi) 705A	Open Voltage	Overload Protection
200Ω	100mΩ	1%+2	1%+2	HiV < 3.5V LoV < 0.25V	250V DC/rms on all ranges
2KΩ	1Ω	0.8%+2	0.8%+2		
20KΩ	10Ω				
200KΩ	100Ω				
2000KΩ	1KΩ				
20MΩ	10KΩ	2%+4	2%+4		

DC Voltage

Range	Resolution	Accuracy 605	Accuracy 705A	Input impedance	Overload Protection
200mV	100µV	0.5%+1	0.5%+1	10MΩ on all ranges	1000V DC/peak AC on all ranges
2V	1mV				
20V	10mV				
200V	100mV				
1000V	1V	0.8%+1	0.8%+1		

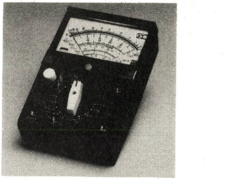
AC Voltage

Range	Resolution	Accuracy (50-500 Hz) 605	Accuracy (50-500 Hz) 705A	Input Impedance	Overload Protection
200mV	100µV	1%+4	1%+4	10MΩ on all ranges Capacitance < 1000pF	750V rms on all ranges except 200mV AC ranges (15 seconds max. above 250V rms AC)
2V	1mV				
20V	10mV				
200V	100mV				
750V	1V	2%+4	2%+4		

DC Current

Range	Resolution	Accuracy 605	Accuracy 705A	Burden Voltage	Overload Protection
200µA	100nA	NC	1%+1	0.3V max	705A: 0.2A fuse up to 250V 605 : 2A fuse up to 250V 10A range not fused
2mA	1µA	1%+1			
20mA	10µA				
200mA	100µA				
2000mA	1mA	1.5%+1	NC		
10A	10mA	1%+1	1%+1	0.7V max	

NC = Not Connected



ANALOGUE WORKHORSE KT370

FEATURES:

- Fuse and diode protection
- hFE measurements 0 - 1000 (by x 10 range)
- Mirror scale for more accurate reading

SPECIFICATIONS
Ranges:
DC Voltage: 0 − 0.1, 0.5, 2.5, 10, 50, 250, 1000V (20k ohm/V)
AC Voltage: 0− 10, 50, 250, 500V, 1000V (8k ohm/V)
DC Current: 0− 0.05, (50uA), 2.5, 25, 250mA
Resistance: 0− 2K, 20K, 2M, 20M ohm
Load Current: 0− 150uA, 15mA, 150mA
Load Voltage: 0− 3V
Volume Level: − 10 −+ 22dB −+ 62dB
DC Current Amplification Factor (hFE) 0− 1000

ACCURACY
DC Voltage & Current: Within +/−3% f.s.
AC Voltage: Within +/−4% f.s.
Resistance: Within +/−3% of arc.
Battery: 1.5V (um-3) 2pcs. 9V (oo6p) 1pc.
Fuse: 0.5A, 5ø x 20mm
Diode: 4148 x 2
C.C. .04uff x 50V
Size & Weight: 147 x 99x 57mm & 400g approx.
"The same type as I have carried in my toolbox since I started in electronics 15 years ago." - Rod Irving

Cat. Q11030 .... **$34.95**

SUPERB QUALITY PROBE SET ONLY $34.95

METEX 3800 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3½ digit multimeter for measuring DC and AC voltage, DC and AC current. Resistance and Diode, for testing Audible continuity and transistor hFE. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...

- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- ½" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001".
- High Surge Voltage protection 1.5 KV-3 KV.
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS
Maximum Display: 1999 counts 3½ digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0°C to +40°C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

Cat. Q91530 **SPECIAL $79.95**

METEX 3530 MULTIMETER

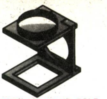
This instrument is a compact, rugged, battery operated, hand held 3½ digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, Capacitance, Transistor hFE and Continuity Test. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...

- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- ½" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001".
- High Surge Voltage protection 1.5 KV-3 KV.
- Capacitance measurements to 1pF
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS
Maximum Display: 1999 counts 3½ digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0°C to +40°C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

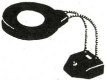
Cat. Q91540 **SPECIAL $119**



FREE STANDING, FOLD UP MAGNIFIER

An ecconomically priced "hands free" magnifier, lets you take care of all those tricky fine detailed jobs so often encountered in electronics, or any of many other practical uses such as home, work, hobbies etc.

Cat. T12083 **$14.95**



DESK MOUNTED LAMP MAGNIFIER

This unit magnifies any object under a clear cool fluorescent light. The magnification is the maximum obtainable (lens 127mm diameter biconvex 4 Dioptres, focal length 254mm) consistent with minimum distortion and eyestrain and good off-angle viewing. It is NOT cheap, but then again it will definitely last a lifetime. It is built like a Rolls Royce! Spare fluoro tubes are available from electrical outlets. If you have trouble with fine PCB work or component identification but still want both hands free, this is for you.

TECHNICAL INFORMATION
Illumination: 22W Fluoroscent
Weight: 81.6Kg
Lateral Extension: 254mm
Vertical Extension: 254mm
Fixing: Heavy table base (grey) with two chrome plated flexible arms.

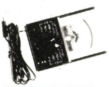
Cat. C92700 **$179**

TRANSISTOR NIPPERS

Normally $13.95!
Cat. T12070 **$11.95**

MICRO NIPPERS

Normally $13.95
Cat. T12050 **$11.95**



2K OHM MULTI METER

11 Ranges, pocket size.
SPECIFICATIONS:
11 RANGES
DC VOLTAGE: 0-10-50-250-1000 volts 2000 ohms/volt
AC VOLTAGE: 0-10-50-250-1000 volts 2000 ohms/volt
DECIBELS: -10 to +22dB in four ranges
OHMETER: 0-10 k/ohms , 0-1 mega-ohms.
DC CURRENT: 1-100mA
Cat. Q11020 Normally $26.95
SPECIAL $21.95

UV EPROM ERASER

Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less for less chips).

Features include:

- Chip drawer has conductive foam pad
- Mains powered
- High UV intensity at chip surface ensures EPROMs are thoroughly erased
- Engineered to prevent UV exposure
- Dimensions 217 x 80 x 68mm

Cat. X14950 **$99.95**

SCOPE 60W SOLDERING SYSTEM

- Infinitely adjustable temp. 200 C to 470 C. Sliding control selects desired tip temperature (LED readout monitors tip temp.)
- Safety holder features ceramic burn-proof bush and can be converted to left-hand-side.
- Soft and cool hand grip in pliable rubber.
- Screw type connector prevents accidental plug removal and guarantees solid contacts.
- Temperature lock allows production supervisors to control soldering temperatures.
- Anti seize tip retention design reduces risk of thread seizure by removing locking nut to cooler end of barrel.
- Optional 30W soldering pencil is available for finer work.

Cat. T12900 **$159**

WELLER WTCPN SOLDERING STATION

The WTCPN Features:

- Power Unit 240 V AC
- Temperature controlled iron, 24 V AC
- Flexible silicon lead for ease of use
- Can be left on without fear of damaged tips!

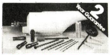
The best is always worth having.

Cat. T12500
R.R.P. $129 Our price $109

SOLDERING IRON ADCOLA RS30

A quality precision soldering tool suitable for many aspects of electronic work.

Cat. T12625 **$29.50**



ARLEC SUPER TOOL

A versatile 12V electric tool for...

- Sanding
- Engraving
- Grinding
- Polishing
- Cutting
- Drilling
- Milling
- Erasing, etc.

Features:
Operates on safe, low 12 volts from mains electricity via AC adaptor (supplied). Light and easy to handle with touch switch and lock for continuous running. High torque motor. 10,000 R.P.M. Can drill 2mm holes in steel. 2 year guarantee

Contents:

- 12V Super Tool
- Plugpack AC adaptor
- 1 spherical milling cutter
- 1 wire brush
- 1 grinding wheel
- 4 drill bits, 0.6, 0.8, 1.0, 1.2mm
- Set of 5 chuck collets
- 6 eraser sticks
- Instruction sheets

Cat. T12300 **$49.95**

STANDARD DESOLDING PUMP

Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 195mm.

Cat. T11241 **$16.95**

MINI DESOLDERING PUMP

Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 165mm.

Cat. T11251 **$15.95**

DELUXE DESOLDERING PUMP

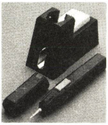
Light weight, non conductive, powerful suction, ceramic long life tip. One of the best in the business. Length 210mm, replacement tip HT3C ceramic.

Cat. T11261 **$22.95**

POWERFULL MINI DRILL

Featuring a powerful 6000 r.p.m. motor, this lightweight (113gm) drill is ideal for many jobs. Perfect for PCB work! Has a 0.8 to 1.2mm chuck and 1mm drill bit. Requires 12V 1 AMP.(use with M19010)

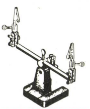
Cat. T12302 **$17.95**



CORDLESS RECHARGEABLE SOLDERING IRON

- Built in solder point illumination
- Easy replacement of solder tip
- Protective stand which also functions as charging unit
- Sponge pad attach to stand
- Plug pack power adaptor
- Includes Nicad battery
- Instructtion manual
- 12 months warranty

Cat. T12480 **$59.95**



PC BOARD HOLDER

Better than an extra pair of hands! A must for all PCB work.

Cat. T12442 **$9.95**

CHANNEL 28 TO CHANNEL 0 CONVERTER

If your TV doesn't have UHF, don't despair! With one of these high quality, specially made converters you can have Channel 28 UHF converted to Channel 0 VHF.

Cat. L15052 **$129**

ARLEC SUPER TORCH

A sophisticated rechargeable torch ideal for use in and around the home, the car, the boat, etc.

FEATURES:

- Powerful built-in Nicad batteries.
- Reflector head swivel through 90 degrees.
- 3 position switch gives on/off/ and dim.
- Indicator lamp when recharging.
- Charges from mains, electricity or from a car battery.
- Supplied complete with
  (A) SEC approved battery charger
  (B) Plug and cord for car lighter socket.
  (C) Handy charging bracket with fixing screws.
- 12 months guarantee.

Cat. A15055 **only $44.95**

P.A. SPEAKERS

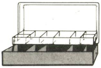
Low dual cone, wide range. 200mm (8in.). Ideal for public address, background music, etc. Tremendous Value at these prices!

Cat. C12000 **$7.95**

RITRON 19" RACK CASE

Tremendous Value! Dimensions 480(W) x 134(H) x 250(D)mm.

Cat. H10415 **Normally $47.95**
SPECIAL PRICE $37.95



MINI UTILITY CASE

Features a clear plastic lid for instant inspection of contents. Up to five, adjustable lower compartments, plus a self elevating upper tray for smaller items.
Dimensions: 110 x 210 x 43mm.

Cat. H10087 **$7.95.**

PROFESSIONAL SERIES RACK MOUNTING CABINETS

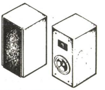
These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance:

- All aluminium construction.
- Removeable top and bottom panels.
- All dimensioning conforms to the International Standard.
- Natural or black finish.
- Ventilated lid.
- Deluxe brushed finish anodised front panel.

		1-4	5+
H10401	Natural	**$49.50**	**$43.50**
H10402	Natural	**$59.50**	**$56.00**
H10403	Natural	**$69.50**	**$63.50**
H10411	Black	**$59.95**	**$57.50**
H10412	Black	**$69.95**	**$65.00**
H10413	Black	**$79.95**	**$75.00**

ATTENTION BARGAIN HUNTERS

We'll give you 5% off all our regular prices if you present this advertisement to our shop staff during April!
(This offer applies only to our regular prices and not to advertised or special prices



2 WAY MID SIZED SPEAKER SYSTEM

Designed specifically for compact disc. Excellent bass response to fully utilize the output capabilities of a compact disc. 16" high, woodgrain finish cabinet with brown cloth grille.

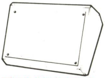
SPECIFICATIONS:
Speakers: Woofers 6½" carbon fibre reinforced polypropylene cone 10oz magnet. Tweeter 1" soft dome 6oz damped with ferro fluid.
Power Input: 40 watts rms 85dB w/m
Impedance: 8 ohms
Frequency response: 50-20,000Hz
Size: 250 x 400 x 240mm
(AVAILABLE MAIL ORDER ONLY)

Cat. C10762 **$299**

JIFFY BOXES

Plastic boxes with aluminium tops, and available in four sizes. Very popular for projects and very ecconomical!

H10101	150x90x50mm	**$ 3.25**
H10102	195x113x60mm	**$ 4.50**
H10103	130x68x41mm	**$ 2.75**
H10105	83x54x28mm	**$ 1.95**
H10110	120x65x38mm	**$ 2.95**
H10112	120x65x38mm (Metal top)	**$ 2.95**



NEW SLOPING CASES

Plastic with metal front panel, available in two sizes:

Cat. H10450	190x120mm	**$12.95**
Cat. H10455	256x185mm	**$21.95**

(measurements are approx. only)

WHAT A RANGE!

Call into our store personally and we'll give you 25% off all Horwood cases during April.

HORWOOD ALUMINIUM CASES

H10382	3 x 4 x 2 inches	**$ 5.50**
H10383	3 x 4 x 3 inches	**$ 6.50**
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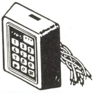

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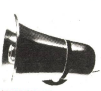

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12V DC, 8W

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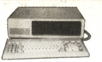

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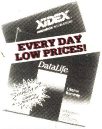

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All prices 10 disk boxes!

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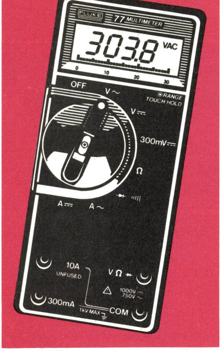

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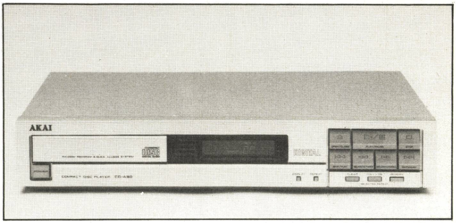
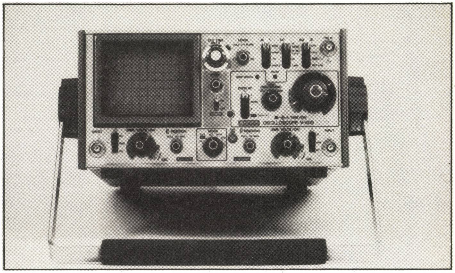


New compact disc player has video output

Akai's new CD-A30 CD player has the usual playing features plus the capability of playing up to 36 tracks in any order. There is also a repeat play and skip/search. A subcode video output jack for the showing of video stills is also on the back of the machine. Compact discs with this feature are expected to be available by the middle of this year.

For further information, contact Akai Audio/Video Australia Pty Ltd, PO Box 309, North Ryde 2113. Phone (02) 887 4416.



Mini portable 50MHz oscilloscope

The Hitachi V509 DC to 50MHz oscilloscope weighs only 5kg and features dual trace and delayed sweep timebase with individual sweep time controls.

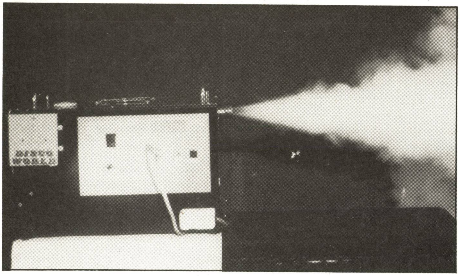
A built in sync separator enables TV/VTR signal measurements to be made while the TV-V and TV-H modes are quickly selectable to ensure stable observation of both vertical and horizontal TV waveforms.

The vertical bandwidth is DC to greater than 50MHz with a rise time of less than 7ns.

Accuracy is ±3% over the temperature range +10°C to +35°C. The A timebase ranges from 0.1μs to 0.2s/div in 20 calibrated steps and timebase B covers the range 0.1μs/div to 2ms/div in 14 calibrated steps.

While it is not apparent from the photograph, the overall dimensions are quite compact: 215mm (W) x 110mm (H) x 350mm (D).

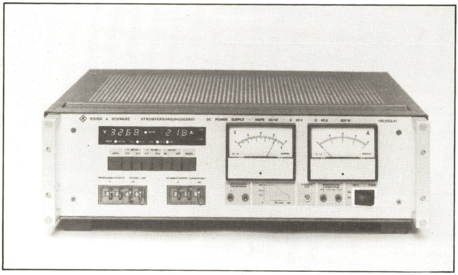
For further information, contact IRH Components, 32 Parramatta Road, Lidcombe, 2141. Telephone: (02) 648 5455.



Dynamite smoke machine for disco and TV

This lightweight smoke machine has ceramic fibre insulation combined with forced air-cooling for safe and efficient production of non-irritating smoke. It has been designed and produced in Australia specifically for use with live bands and in film and television production.

For more information contact Disco World Pty Ltd, 300 Main St, Lilydale 3140 or at 673 High St, Preston. Phone (03) 735 0588.



Programmable power supplies

The NGPE 40/40 is a new power supply from Rohde & Schwarz which can be programmed via the IEEE-488 bus for system and laboratory applications or manually operated. Featuring decade switches for all settings, the instrument supplies voltages and currents of high resolution (10mV and 100mA) and reproducibility in the range of 0 to 40V and 0 to 40A.

The NGPE is a double flyback converter design, giving good settling times and low noise. In addition, higher currents are available at low voltage settings. At an output of 15V the output power is as high as 600W (40A).

The range of the ammeter is switchable between 40A and 4A. LEDs are provided for indicating the selected operating mode, status signalling, input data and IEEE-488 bus commands. Parallel-connected monitoring outputs are available at front and rear panels.

For further information, contact Rohde & Schwarz Australia, 13-15 Wentworth Avenue, Darlinghurst, 2010. Telephone: (02) 267 2622.

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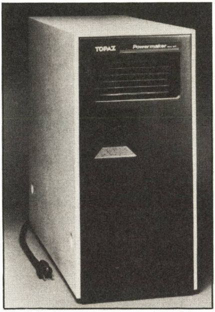
Uninterruptible power supplies for computers

Online Control have released a range of uninterruptible power supplies from Topaz. The Topaz micro UPS range has been designed to suit personal computers, mini-computers and other power dependant equipment such as PABX telephone systems.

The device provides battery-backed AC sinewave power for up to 35 minutes at full load. This enables continuous operation through the majority of power interruptions, while also giving time during longer power failures to shut down in an orderly manner.

For more information, contact Online Control Pty Ltd, 2/7 Waltham Street Artarmon, 2064. Telephone: (02) 43 1313.



Remote system controller from SME Systems

SME Systems has developed the Micron, a smart box that provides security of access for modem-connected computers. Micron verifies the caller's security password and then switches on the host computer and gives the caller access. This means that it is no longer necessary to have unattended computers powered up for long periods; a saving in power costs and reduction of fire risk.

Micron also enhances cheaper modems by providing auto dial, auto answer and baud rate conversion. The system is available at a recommended retail price of $295 plus tax.

For further information, contact SME Systems, 22 Queen St, Mitcham, 3132. Phone (03) 874 3666.

Digitally controlled antenna tuner

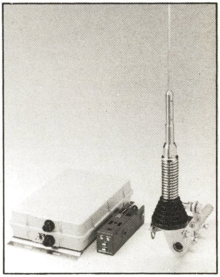
Icom have a new digitally controlled antenna matching unit for frequencies between 3.5MHz and 30MHz. Designated the AH-2, it has been designed for mobile applications where broad band antenna matching has traditionally been a problem. The unit consists of a control unit that is positioned beside the radio and a tuning unit that mounts close to the whip antenna which is also supplied.

The operator selects the desired frequency and pushes the tune button on the control unit. The internal CPU then selects the most favourable LC combination for the given length of the whip antenna and the operating frequency. Worst case tuning time is 20 seconds but typically, it takes four to five seconds.

The maximum input power is 120 watts and unlike normal tuners that require full output power during the tune-up period, the AH-2 derives the frequency information direct from the transceiver during use. For a short period after this, 300mW of power is needed to check the tuned L/C mix selected by the CPU.

The tuning unit assembly is housed in a tightly sealed plastic case to provide dust and water-proofing.

For further information, contact Icom (Australia) Pty Ltd, 7 Duke Street, Windsor 3181. Telephone: (03) 512 284.



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JVC personal portable CD player

JVC have announced the release of the world's lightest compact disc player, the XL-R10. Weighing in at only 440 grams, the XL-R10 has 15 channel random access, skip/search and full digital display of track, time and program. The price however, is yet to be announced. For more information, contact Hagemeyer (Australasia) B.V., 5-7 Garema Circuit, Kingsgrove, 2208. Phone (02) 750 3777.

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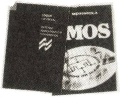

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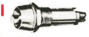

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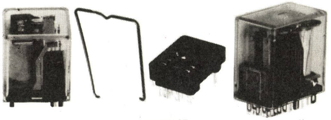

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6.3mm (1/4") by 32mm plain shafts.
OEM Quality

Cat. No.	Pos.	Poles
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S 3003	3	4
S 3004	4	3
S 3005	5	2
S 3006	6	2
S 3012	12	1

Were $1.70 Now $1.25

Miniature Rocker Switch with Indicator Dot

Low cost snap action rocker switch Ideal as mains switch etc. SPST **25V 6A rating. Panel cutout required 19 x 13mm.**

S 3210 **$1.80**
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S 3070
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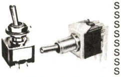

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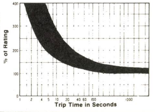

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H 1022	Hex Nut	500	6.50
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H 1060	6 BA x 12mm	25	1.05
H 1062	6 BA x 12mm	500	8.50
H 1070	Nut Hex 4 BA	25	1.10
H 1072	Nut Hex 4 BA	500	16.50
H 1080	Nut Hex 6 BA	25	1.10
H 1082	Nut Hex 6 BA	500	13.75
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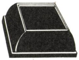

	Size (diam.)	Pack Qty.	Price
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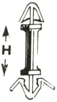

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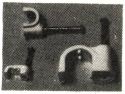

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H 1722	Coax cable	200	**8.95**
H 1730	7-9mm cable	30	**1.95**
H 1732	7-9mm cable	200	**9.50**
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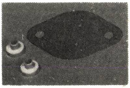

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PO Box 227,
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50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly 3d

April 1936

Long range crystal: an Italian Professor has invented a crystal, or detector, receiver which is claimed to receive from distances up to 2000 kilometres. He admits it is not much use for long distances when it is near a powerful transmitter, but it is good for country places, especially since it requires no power. He hopes eventually to make it more selective and considers it can be sold "at such a price that practically anybody will be able to afford it."

Battery amplifier: here is the description of the Universal Amplifier, adapted for battery operation. A six volt accumulator and genemotor supply the power. It is ideal for country dances and other public address work.

It is essential that the accumulator driving the outfit should be a big one. A large 100 ampere, or larger, car battery would be suitable. The overall drain of the circuit would be about 13 amps.

The use of 350 volts on the plates of the pentodes gives enough gain to allow at least eight watts undistorted power.

Pocket transmitter: all the papers are talking about the smallest transmitter in the world, invented by the chief engineer of the NBC of America. You can carry it in the palm of your hand, or in your coat pocket, and it will send for miles. They are also testing a waistcoat pocket transmitter. The present one is a three inch cube, with two ten-inch rods for aerials, acorn type valve, power of 0.2W from a 90V battery weighing less than four pounds. The transmitter itself weighs less than a pound.

RADIO, TELEVISION and HOBBIES

April 1961

Electronic nerve: scientists at Bell Laboratories have put together on a three inch by four inch circuit card a simple electronic device that outwardly imitates the living nerve cell, nature's tiny building block of the nervous system.

Using a number of the inexpensive cells, research men have recently begun attempts to follow nature further. Cell by cell, they are building electronic systems that imitate some of the simple workings of nerve networks in the eye and ear — the human end of the communication chain.

Heat shield: one of the toughest problems in space engineering is presented by the heat barrier; extremely high temperatures generated by air friction when a space vehicle re-enters the earth's atmosphere at speeds around 18,000 miles an hour.

For nearly two years Boeing research men have been working to develop a coating to protect metals against deterioration from heat and air friction. A coating recently devised has the desired qualities.

Described as the Disil process, the coating is being used at the Boeing plant on test parts. It involves the application of silicon and other materials to the surface of molybdenum at between 1,700 and 2,000 degrees F.

Channel Bridge: current moves to get started on a tunnel beneath the English Channel have sparked off counter proposals for a channel bridge. Several very highly placed British engineers and several large engineering firms are backing the bridge as a better solution to the whole problem than a tunnel.

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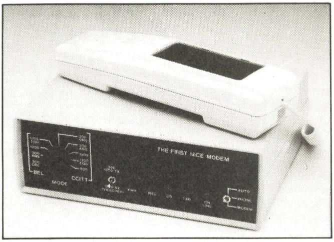

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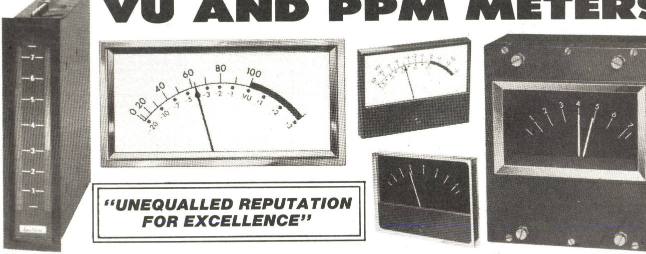

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In the beginning there was the spark . . .

The basics of early radio transmitters

Before the invention of the valve, radio transmitters used spark generators to produce RF energy. Marconi, Hertz and Lodge developed this crude system into a highly effective radio communications system.

by PETER R. JENSEN, VK2AQJ

It was in the early 1950s that the author was first introduced to wireless in a rather tentative way. This introduction involved a spark-gap type Morse code practise set originally designed for the Australian Army and presented to the author by a radio enthusiast.

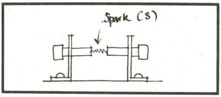
This most elementary of transmitters simply consisted of a piece of wire connected to the active side of the tiny spark gap. By using a pair of Government surplus earphones, hooked up to a simple crystal set, it could be received at least 50 yards away, down the end of the back garden. No doubt it could also have been heard by anyone else in the vicinity with any sort of radio.

Fortunately, most of the author's radio broadcasting occurred during the daytime, in school holidays, and so this illegal activity remained undetected. At least, no-one went to the Radio Inspectors and the author was not carted off to some jail for schoolboy experimenters. Perhaps Marconi had the same sort of luck.

In the upshot, this episode was to have two major results. The first, and perhaps the most predictable, was that the author obtained an amateur radio licence nearly twenty years later. The second was an abiding interest, on the part of the author, in spark transmission which changed over time to a more general interest in all forms of ancient radio, or wireless as it was known even in the 1950s.

In quite recent months, spurred on by the threat of an impending Jamboree of the Air (JOTA), the author made a decision to put together a replica of an early spark wireless system to amuse the scouts and guides. Despite a lot of propaganda to the contrary, the author suspected that the kids probably found those "black boxes" all rather a yawn. These days, almost anyone can own a CB, can't they?

To some considerable extent, this project was also sparked (pun entirely intentional) by a good deal of reading on the history of radio and by a visit to an excellent wireless display at the Science Museum in London four years ago. It is fair to say that what started out to be a fairly simple project got rather out of hand and seemed to develop a will of its own.



Above: a simple spark gap. The spark is generated by applying a high voltage to the terminals.

Indeed, having indulged in an orgy of spark wireless development, the author has achieved a little insight into the fascination that must have propelled Marconi along his path of exploration.

At the end of the exercise, the main consolation for the time spent is that the author has at last heard the "song of the syntonized spark" which, in an age of integrated circuits, must be counted something of a rarity. It should hastily be added that this achievement was made without benefit of any form of antenna and at extremely low power, late at night, so as to avoid any interference with anyone in the vicinity.

Before describing the apparatus that was constructed it is essential to discuss some of the background to the generation of spark radio frequency energy. Without such a step it will be difficult to explain how the crude, broad and raucous hash that Marconi first produced was converted into a signal that, by 1914, so nearly imitated the continuous waves that later only the thermionic tube could produce.

It was something closely approximating this that was ultimately obtained in the apparatus to be described.

Marconi

For most radio amateurs, Marconi probably represents the starting point of radio communication as we know it today. This is quite appropriate for there is no doubt that Marconi was the

Guglielmo Marconi with his experimental wireless apparatus of 1897. The black box contained the spark transmitter.

original and most extraordinarily prolific amateur. From a negligible scientific background, he pursued radio communication until his death in 1937 and it was a pursuit that ranged through all the length of the radio frequency spectrum. Over the forty years from 1896 to 1936 his work extended from the very high frequencies initially, down to the extremely low frequencies and ultimately back up to the high and ultra-high frequencies.

However, in his own time Marconi was often criticised for being simply an imitator who had brought together a large number of pre-existing discoveries and turned them into a workable communication system. While such criticisms are perhaps to some extent valid, the simple fact of the matter still remains that, not only did he make the first radio communication system work, but he also carried it through its fledgling stage to see it become an industrial giant spanning the world.

Of the scientific pre-cursors of Marconi, there are probably two well-known personalities that should be recalled. They are Heinrich Hertz, who in 1887 demonstrated, and then was able to measure and define, the characteristics of radio frequency energy, and Clark-Maxwell who had laid the theoretical foundation of Hertz's research some 24 years previously.

However, there are two other largely forgotten heroes of the radio age. These are two Englishmen, Michael Faraday and Oliver Lodge. The first, Faraday, might well lay claim to be known as the great-grandfather of radio. From a largely non-technical background, Faraday suggested the existence of the electromagnetic field and speculated on the possibilities of radiation via this field (later to be confirmed through the work of Heinrich Hertz). Indeed, it appears that Clark-Maxwell's mathematical treatment of the electromagnetic field was a direct outcome of this earlier speculation on the part of Michael Faraday.

Oliver Lodge

Oliver Lodge's contribution to the science of radio communication was to become the crucial element in establishing the use of the radio frequency spectrum. What Lodge discovered and demonstrated was what he referred to as "syntony". This has subsequently come to be known as "tuning".

Syntony or tuning is the means by which the frequency or wavelength of radio frequency energy is determined and which thus allows its position in the radio frequency spectrum to be established. The crucial experiments of Lodge were conducted at least two years before Marconi's first demonstrations in 1896.

Indeed, it was claimed by a number of people, not least Lodge himself, that he had, in fact, achieved effective radio communication before the demonstration by Marconi. What is certain is that a demonstration was made of the propagation of radio frequency energy but to what extent it differed from the earlier experiments of Hertz is not at all clear. However it was subsequently asserted by Lodge that Morse code had been transmitted and that this represented the essential ingredient of a communication system.

While controversy raged in relation to this claim, far more contentious, but less public, was Lodge's claim to have discovered "tuning".

It had not taken Marconi very long to realise the significance of tuning as an attribute of an efficient transmission and reception system. Spark transmission

The basics of early radio transmitters

was inherently very broad-band and very noisy and, without tuning, all that the various operators could hear were many different signals overlaying each other — a sure prescription for complete bedlam. In the early days, this is clearly what the use of the radio frequency spectrum represented.

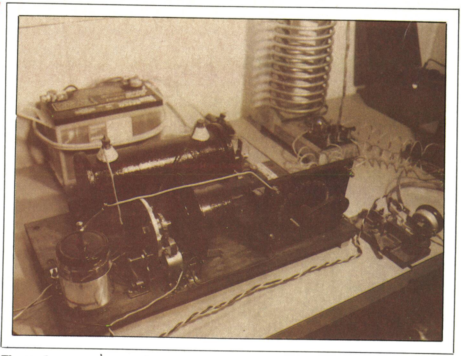
Tuning made all the difference. By this means it was possible to share out the various parts of the radio frequency spectrum and, to a great extent, avoid the overlap of signals which caused so much confusion and "jamming". Marconi's response to this realisation was to patent a system of tuning of his own which was embodied in what was to become known as the famous four sevens Patent (No. 7777) of 1900. However, this was disputed by Lodge from the outset and it took the best part of eleven years for the dispute to be resolved.

While the litigation did not, in the end, go to court and an out-of-court settlement was made, the contents of which were not publicly revealed, it seems fairly clear that Lodge's priority was firmly established. Furthermore, the Marconi Company appears to have bought the rights to Lodge's patent for a very considerable sum.

Spark generation

Turning now to the elements of the early spark transmission and reception system, let's first consider that most important component, the spark itself. While every rapidly changing electric current, such as occurs in the armature of an electric motor, produces electromagnetic energy at audio frequencies, such energy is not of great practical use for communication. The problem with early wireless was to discover a way in which a high enough frequency of alteration could be produced, which would indeed generate electromagnetic radiation and which could usefully serve as a medium for communication.

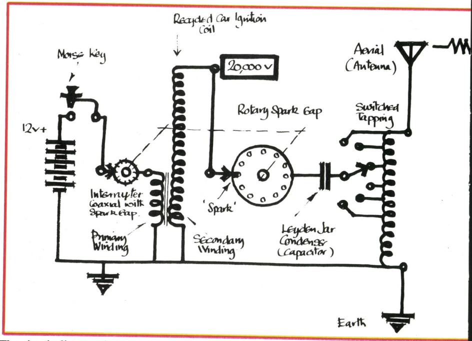
These days, anyone involved in radio appreciates that, by means of either a thermionic or solid state device, it is possible to generate continuous oscillations at radio frequencies. In 1896, such devices were far in the future and clearly something else was necessary. The spark effectively provided the radio frequency "trigger" that was needed.



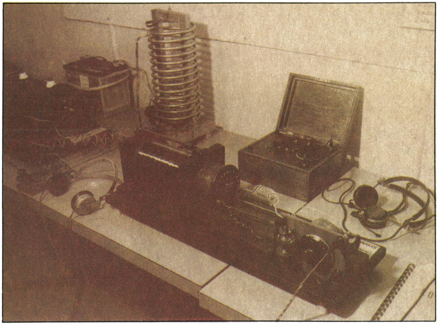
The synchronous rotary spark transmitter. Note Leyden jar condenser at bottom left.

Although not visible to the naked eye, when a spark is struck across a gap, at high potential, the electric current surges back and forth at a radio frequency rate and thus immediately produces energy of the right characteristics for communication purposes. The drawback is that spark oscillations do not possess frequency "cleanliness" — ie, the energy is not all generated at a single frequency.

On the contrary, because the means of generating the high voltages, required to strike the spark, is based on switching a current, the sparks are either on or off. Since in that respect they are generated as packages of square waves, rather than sinusoidal waves, they tend to be extremely rich in harmonics. As anyone who has had interference from an improperly screened motor vehicle ignition system injected into their radio can confirm, such ignition noise frequently can be tracked all the way across the high frequency band from below 1MHz to 30MHz and often



The circuit diagram for the author's synchronous spark transmitter.



The companion receiver uses a loose coupler and a cat's whisker detector.

very much higher.

In fact, Hertz's early experiments with spark propagation were conducted at about 120MHz. And prior to Marconi's development of transmitting apparatus, his mentor, Professor Righi in Italy, was carrying out spark transmission experiments far up into the gigahertz range which was not to be revisited by radio men for many years thereafter.

Funnelling the rough, raucous and broad-band spark-generated radio frequency energy into a tuned circuit certainly improved the situation. Under these circumstances, the spark energy shocks the tuned circuit into resonance at its natural frequency. Even so, there is still a broad and effectively untunable spectrum of energy generated.

Thus, most of the problems of spark transmission lie in the character of the spark itself. After Marconi's original work in 1896, it was very quickly discovered that an electric arc, as used in welding, would produce a relatively clean radio frequency signal, although of rather lower power. Indeed, the arc signal was sufficiently clean for it to be used as a carrier for audio frequency modulation after about 1910. This no doubt influenced Marconi at a later stage to strive for ways to clean up the character of spark generation.

Even in the original apparatus Marconi took with him to England in 1896, some effort had already been made to improve the method of the spark generation. Although not entirely clear, because, in true "showman-like" manner his apparatus, was hidden inside the original "blackbox", it seems that Marconi had already discarded the self-actuating trembler, which was the norm of Ruhmkorff (induction) coils of that period, in favour of a rotary interrupter.

Having now trodden the same path in the search for a clean spark, it is quite obvious to the author why this change was made at such an early stage. The spark generated by a trembler is particularly rough, ragged and difficult to adjust whereas that from an accurately made rotary interrupter is relatively docile and certainly a good deal cleaner.

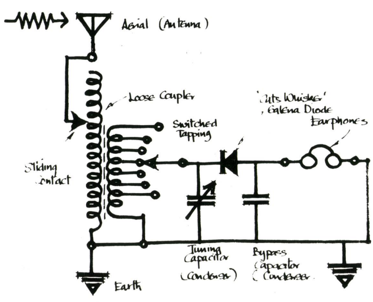
Improvements

The urge to improve the characteristics of the spark continued to propel Marconi along a development path which, in 1914, saw a system significantly different in both mechanical and electrical terms to the original apparatus. Instead of using battery power and a rotary interrupter to provide chopped 'direct' current, power was now delivered by a rotary alternator running at approximately 500 cycles per second (Hertz). The spark, instead of being generated between fixed points, occurred between the surfaces of three rotating steel plates.

The centre circular steel plate was spun at high velocity along the axis of the alternator shaft. On either side of the main plate, and set at right angles to it, were two smaller steel plates which rotated far more slowly. The sparks jumped between the two sets of gaps formed and, as originally constructed, the main purpose was to avoid erosion of the spark gap due to the high energy involved.

As installed in the Transmission Station at Clifden in Southern Ireland, this apparatus produced an extremely powerful, clean and easily tuned spark. Indeed it was so clean (close to a single frequency) and lacking in normal noise modulation, that it was in fact very difficult to read at the receiving end.

It did not take Marconi very long to realise that modulation was required in order to make the signal audible. This was achieved very simply by including a



The receiver can be tuned to receive broadcasts at frequencies up to 1.8MHz.

The basics of early radio transmitters

series of metal studs around the two opposite surfaces of the central disc. Originally there were 12 in number but this was increased shortly afterwards to 24. The studs were arranged so as to synchronise with the output from the rotary alternator and the result was described by a contemporary observer as being quite incongruous.

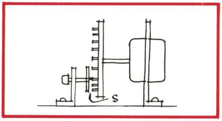
What it produced was an extremely powerful 800Hz whistle. However, this proved to be an immense improvement for it was easily heard on the other side of the Atlantic, cutting through static and other interference which, even to the trained ear of the Marconi Company operator, could at times sound like the output of a conventional spark apparatus.

The second essential element of any transmitting and receiving system was the manner in which the signal was to be detected at the receiving end. In Hertz's original experiment, this had been achieved by direct visual inspection of a receiving antenna, which contained a spark gap. Here a spark could be detected as the receiving antenna picked up energy from the transmitted radiation.

Subsequently, in 1896, Marconi made use of a device known as a "coherer" which relied on the rather peculiar electro-mechanical properties of fine metal particles. When fine metal filings are exposed to a radio frequency field they tend to clump together, forming a conducting path. It was therefore possible to make such filings operate as a rather crude form of relay.

A low voltage circuit was connected in series with the coherer which contained a bell, trembler or some other device for producing the sound or symbols of Morse code. In addition, the coherer formed a part of an antenna system so that it was exposed to radio frequency energy. Thus, when radio frequency energy was passed through the coherer, the filings tended to stick together and the bell would ring.

One major disadvantage of this rather crude system was that when the radio frequency energy was no longer available, the metal filings continued to stick together and had to be tapped back into a loose state to break the circuit. This was ultimately achieved by using the same bell or trembler, which registered the signal in the first place, as a tapper.



Above: the asynchronous rotary spark discharger. The spark is produced between the fixed electrode and the studs on the large rotating disc.

Soon after the introduction of the new wireless technology, experimentation on numerous fronts provided a number of new means of detection involving crystals of various sorts. Originally, the crystal detector was made of carborundum but soon other crystals were found to provide rectification.

Cat's Whisker

Ultimately, the most common and probably best known of these detectors was the so called "Cat's Whisker" which employed a crystal of silver and lead (Galena) as one pole of the detector and a spiral of silver or platinum wire as the other pole. This coil of wire was brought into contact with the surface of the Galena and, when a sensitive spot was found, this arrangement would detect or rectify the radio frequency alternating current.

This form of detection suffered one major problem however: it was mechanically unstable. The slightest knock or jolt would throw it out of contact and the operator would have to spend considerable time fiddling about to again find a sensitive spot on the face of the crystal.

Because of its involvement in maritime activities, the Marconi Company searched around for a more reliable form of detection. Eventually, its research team came up with a rather unusual electro-mechanical system which made use of the magnetic and hysteresis properties of iron wire. The "Maggie" (short for Magnetic Detector), as it was called, consisted of a continuous strand of wire which ran around two drums. This was driven by clockwork so that the wire ran slowly and continuously through a small solenoid which was connected into the antenna system of the receiver. In parallel with the primary solenoid winding to the antenna was a secondary solenoid winding which ran to a pair of headphones. In addition, there were two horse-shoe magnets which straddled the solenoid.

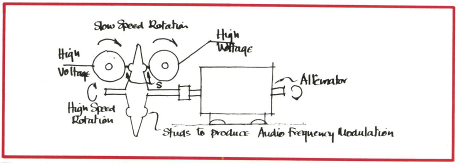
Again, this form of detection provided direct conversion of the radio frequency energy to an audio frequency signal. It was simple, reliable and resistant to the sort of physical shocks received by vessels at sea.

However, the "Maggie" was relatively insensitive and the Marconi Company tended to compensate for this disability by increasing the power of the transmission stations at either end. By 1914, the two major transmission stations at Clifden in Ireland and Glace Bay in Novia Scotia were generating powers of about 300 kilowatts, radiated via antennas which were gargantuan by today's standards.

Tuning

The third critical element of the transmitter and receiver system, although not recognised as such by Marconi initially, was the question of 'syntony'. Marconi came to call this technique 'tuning' when finally he realised its significance, no doubt somehow to distinguish it from Oliver Lodge's patent. Tuning, of course, is taken for granted by the contemporary generation of radio and television users.

Once a means of transmitting and detecting radio frequency energy is achieved, tuning represents the crucial means by which it can be controlled. Syntony, or tuning, is the method by which a particular part of the radio frequency spectrum can be allocated as the



The synchronous spark discharger. In this scheme the spark is produced between two sets of rotating plates. Note studs to produce audio frequency modulation.

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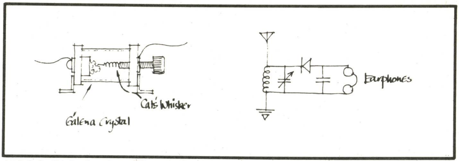
The basics of early radio transmitters



At left is the basic scheme for a cat's whisker detector while at right is a simple receiver. The diode represents the detector.

location for a signal to be transmitted and received.

The fourth critical element in early wireless systems was of course the antenna, or aerial as it was called at that time. In Hertz's experiments, the antenna used was simplicity itself. It consisted of a dipole, sometimes with end-loading in the form of metal plates or balls and presumably derived from the construction of the Leyden jar. The frequency of the energy propagated by this system is believed to have been in the vicinity of the present 2-metre amateur allocation and, accordingly, had the same limitations of "line of sight" propagation.

In many respects, it was Marconi's early work in developing the long wire vertical antenna system, and the attendant increase in wavelength of the transmitted signal, that was to so dramatically increase the range of wireless transmissions. Despite this, Marconi appears to have still used Hertzian type antennas for demonstrations of directional transmission in England after 1896.

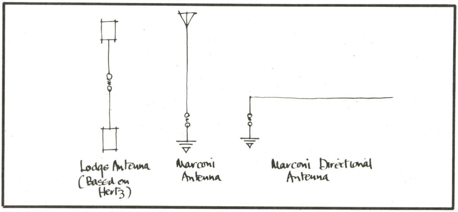
His great "breakthrough" was undoubtedly the discovery of the vertical antenna that still bears his name. What Marconi did was to turn the dipole of Hertz vertically and connect one leg to the ground. By progressively extending the other leg upwards, the range was accordingly increased. This effect seemed to reach an optimum at around 45 metres, at which stage "sky wave" propagation probably took over although, at this time, the effect was quite unknown. Indeed it was assumed that some form of atmospheric refraction was occurring.

A practical system

Having discussed in general terms the key components of a Marconi-style transmission and reception system, let us now look at the station that was built for demonstration purposes. Let's first consider the source of the high voltage for generating the spark.

The historically accurate method of achieving this is by means of an induction coil known, in the early days, by the name of its inventor, Ruhmkorff. In principle, the induction coil is a relatively simple device consisting of a primary winding, through which a low voltage current is allowed to flow, with some form of interrupter to convert it into chopped direct or fluctuating current, and a very large number of turns for the secondary to produce the high voltage.

For the amateur constructor, making such a device is by no means easy. In Fleming's book, given in the references, the secondary winding for the standard induction coil used at that period (to achieve a 10cm spark) is described as consisting of approximately 27km of fine wire wound in a series of flat toroids. The toroids consisted of wire spirals wound from the the inside to the outside and then connected through to the next toroid, the whole collection being packed together into a cylindrical tube and sealed at the ends.



The Lodge antenna (left) consisted of a dipole with end-loading in the form of metal plates. At centre and right are two variations of Marconi's long-wire antenna.

The purpose of this construction was to ensure that no part of the winding was at a significantly higher voltage than any other part and to avoid internal sparking over.

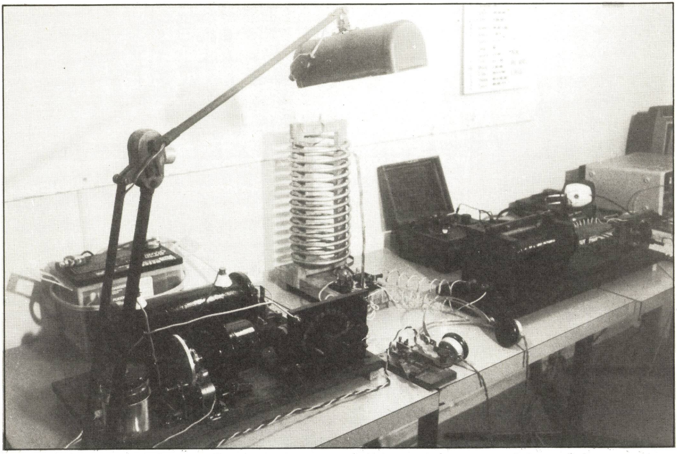
Clearly this is not something to be tackled lightly and, after considerable head scratching, it was decided to take the easy way out and to make use of technology almost as old as radio itself. A secondhand ignition coil formed the basis of the required induction coil system. However, in the interest of visual authenticity, the car ignition coil was buried in a cardboard tube complete with end plates and ceramic terminals: This can be seen in the diagram and pictures.

The car ignition coil differs from the Ruhmkorff coil in one important respect in that it has a common earth terminal for both the primary and secondary coils.

Initially, a simple self actuated 'trembler' was used to interrupt or chop direct current from a 12V car battery. Again, the general construction of this trembler can be seen from the drawing. However, it was very soon discovered that the results of this were extremely hard to control and the spark produced was rough, ragged and certainly quite unmusical. Even so, the trembler was good enough to at least demonstrate that a good solid spark could be produced.

The next stage was relatively straightforward and involved the construction of a Leyden jar as the primary capacitor (condenser) and a tapped coil in order to control the frequency of operation.

The tapped coil again consists of a cardboard drawing tube, approximately 50mm in diameter, onto which was wound about 60 turns of 16SWG cotton covered copper wire tapped off to a series of studs with a rotating wiper



Above: full view of the author's Marconi-style spark transmitter and crystal receiver.

contact. The components of this stepped switch were salvaged from elderly direct current electrical gear. The tapped coil and switch were later mounted on a baseboard next to the spark discharger that was ultimately constructed for the transmitter.

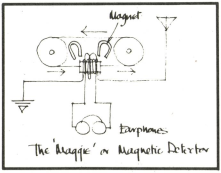
Initially, the capacitor consisted of glass plates used as separators between small sheets of galvanized sheet metal and held between the faces of plywood boards. However, considerable sparking over occurred around the connection between the capacitor terminals and the plates and this method was finally abandoned in favour of the much simpler and more robust Leyden jar.

In this case, all that was required was a discarded jam jar with its lid punched to receive a brass terminal rescued from a well filled junk box. An internal sleeve of tin plate, cut from a discarded food tin, was set inside the jar. A short piece of tin plate was cut and soldered to the lid of the jam jar, to form a springy contact onto the inner sleeve. An outer sleeve was also constructed and once in position, received a terminal to provide a contact to the stepped coil.

Finally, a simple spark gap was constructed and consisted of two brass angles with heavy duty brass nuts and bolts threaded through them of approximately three millimetres diameter.

Receiving system

Stage 1, the production of a roughly tuned spark transmitter, had been achieved and it was time to turn to a receiver to complement the transmitting system constructed so far. Two crystal sets were already sitting in the cupboard from previous historical reproduction projects but they did not seem to fit the bill, either technically or visually, being based on designs of the early 1920s.



Although robust, the "Maggie" detector was insensitive and resulted in the construction of large transmitting stations.

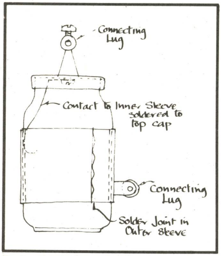
Fortuitously, at this time, a letter from Mr John Bull appeared in *Electronics Australia*, offering, to any interested party, a working "loose coupler". Following a quick phone call, the carefully packaged unit duly arrived at the author's residence and proved to be ideal for the intended project.

An early variable condenser (capacitor) had already been purchased in the UK some years ago together with a glass enclosed 'cat's whisker' detector. These two components, together with the required terminals, were mounted on a separate sub-base of plywood. This, in turn, was mounted together with the loose coupler on a common base board. The coupler was in very clean condition and, after some minor internal wiring connections had been repaired, the whole assembly was given a fresh coat of varnish. It now looks much as it did when first constructed by John Bull and his father in 1923.

A set of good quality, high impedence 'Brands' earphones and a modern diode detector completed the receiver.

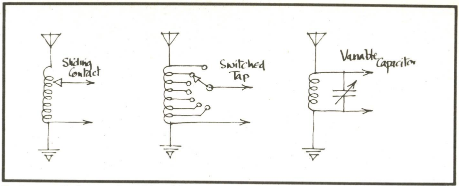
The basics of early radio transmitters

This equipment was capable of being tuned up to 1.8 megahertz, the frequency which had been selected for the transmitter. It also produced very acceptable sound from the AM broadcast band when connected to an 80-metre band antenna.


Connecting Lug
Contact to Inner Sleeve soldered to Top cap
Connecting Lug
Solder Joint in Outer Sleeve

Basic scheme for a Leyden jar condenser. It is made using a discarded jam jar, scrap pieces of tinplate, and brass terminals.

Stage 2, the receiver, was now completed and attention returned to that ragged spark produced by the simple trembler switch. After much consideration, it was decided to try the most technically advanced form of spark generation, the so-called 'singing' spark.



Syntony or tuning can be achieved by means of a sliding contact (left), switched taps (centre), or a variable capacitor (right).

This had originally been produced by synchronizing the discharge of the spark with the peak voltage obtained from a 500Hz alternator set, which resulted in an audio frequency modulation of the basic spark carrier energy.

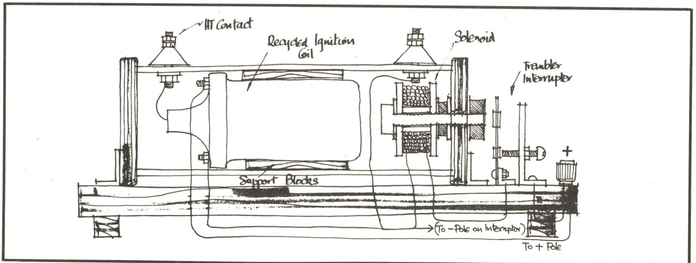
Again, the 'singing' spark as it was known, had the immensely valuable property of being audible through static and other man-made interference.

The motor to drive the rotary plate, upon which are mounted the spark discharge studs, was salvaged from a car wrecker's yard. This motor had formerly been used to drive an air-conditioning fan and drew a healthy two amps from the car battery to excite its stator field and power the rotor. A number of experiments were undertaken before the arrangement illustrated, with a common earth return for both the high tension secondary winding and the low tension primary winding, was evolved. In this arrangement, the common earth connection is a spring loaded wiper which bears on the rotating shaft which, at this point, consists of a piece of brass plumbing hardware.

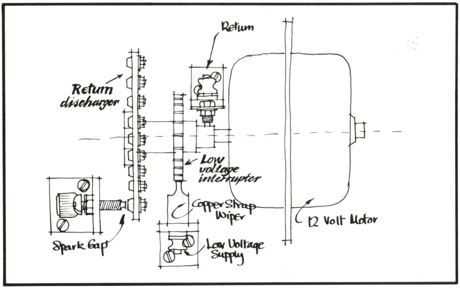
The need for synchronization of the interrupter and the discharger led to the arrangement shown in the sketch in which the cuts in the interrupter plate are on the same radial lines as the studs of the discharger plate. Thus current flows through the primary of the induction coil during the period of rotation between studs of the discharger plate. At the instant that the stud on the discharger is opposite the fixed spark gap, the current to the primary of the induction coil is broken. As the field collapses a strong voltage pulse is generated in the secondary winding, causing the spark to jump the gap. In principle, this achieves very much the same result as the Marconi system of 1912 to 1914 using alternating current.

A shaped brass wiper provides the contact to the rotary interrupter. Due to the high speed of rotation, the rotary plate also generates a considerable amount of audible noise, quite apart from the crackle of the spark discharge.

Construction details for the rotary spark discharger can be obtained from the drawings and the photographs. The discharger plate was cut from 6mm-thick aluminium sheet and had 3mm



The high voltage generator was based on a car ignition coil buried inside a cardboard tube. Initially, a self-actuated trembler was employed but this was later replaced by a synchronous rotary spark discharger.



Plan view of the synchronous rotary spark discharger. When a stud on the discharger disc is opposite the spark gap, the interrupter breaks the current through the induction coil.

diameter brass studs set in its surface with their threaded shanks projecting to the rear to receive a brass nut. This projecting shank also provides a position to attach additional nuts to offset minor vibrations caused by eccentricity of the rapidly spinning plate.

The 6mm-thick interrupter plate was cut from a cylindrical block of brass approximately 40mm in diameter. The slots in its surface were cut using a fine-tooth hacksaw and then finished with a fine metal-working file. They were then packed with small pieces of perspex acrylic sheet to provide a smooth bearing surface for the copper wiper.

It should perhaps be added that the whole of this equipment was put together without the aid of a lathe. However, an electric drill was found to be indispensable, not only for drilling holes but also for rotating aluminium and brass sheets to prepare the circular plates for the discharger and interrupter.

One final word of warning to anyone who decides to undertake a similar project. Constructors should not be complacent about the jolt that can be received from an ignition coil in this type of configuration. Although probably not particularly dangerous, because of the low capacity of the primary condenser in the system, it can nevertheless deliver a vicious shock.

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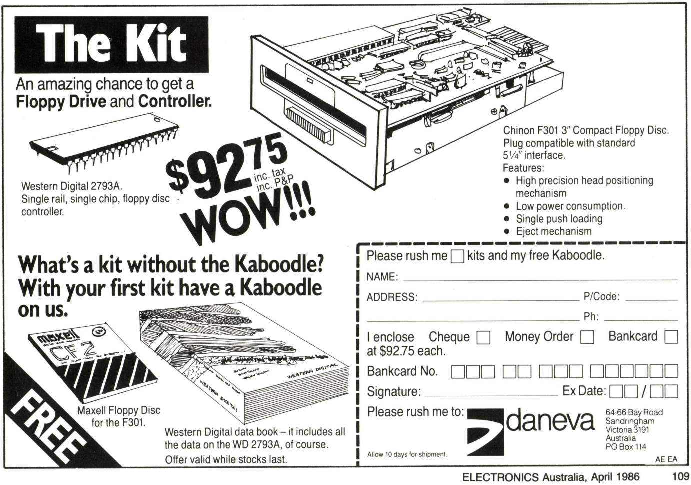
(5) "Guglielmo Marconi — 1874-1937", Keith Geddes, HMSO 1974.



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SENTIMENTAL ME, Polygram, 412433-2.

DIMEOLA, AL
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DIRTY DOZEN BAND
MY FEET CAN'T FAIL ME, Festival, CD 39035.

DIVINE
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DOLBY, THOMAS
GOLDEN AGE OF WIRELESS, EMI, 746009; THE FLAT EARTH, EMI, 746028.

DOMINGO, PLACIDO
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DR. HOOK
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THIEF IN THE NIGHT, Elektra/Asylum, 60398-2.

DURAN DURAN
ARENA, EMI, 746048; DURAN DURAN, EMI, 746042; RIO, EMI, 746003; SEVEN & THE RAGGED TIGER, EMI, 746015.

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DIGITAL DIXIE, Polygram, 800065-2; DIGITAL DUTCH, Polygram, 814068-2; SWINGING STUDIO SESSIONS, Polygram, 824256-2.

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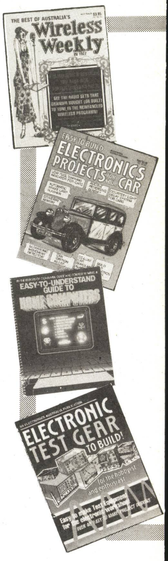
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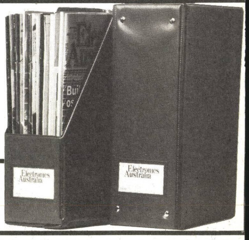

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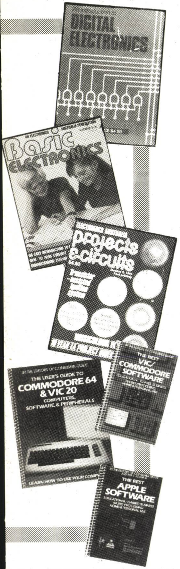
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POWER SLAVE, EMI, 746045.

J. GEILS BAND
FREEZE FRAME, EMI, 746014.

JACKSON, JANET
DREAM STREET, Festival, CD38252.

JACKSON, JERMAINE
DYNAMITE, Festival, CD38317.

JACKSON, JOE
LOOK SHARP, Festival, CD 36928.

JACKSON, MAHALIA
IN THE UPPER ROOM, Vogue, 6000 61.

JACKSON, MICHAEL
OFF THE WALL, CBS, CDEPC83468; THRILLER, CBS, CDEPC85930.

JACKSONS, THE
TRIUMPH, CBS, CDCBS86112; VICTORY, CBS, CDEPC86803.

JACOBS, PAUL
PLAYS BLUES, BALLADS AND RAGS, WEA, 790062.

JAGGER, MICK
SHE'S THE BOSS, CBS, CDCBS86310

JAM, THE
COMPACT SNAP, Polygram, 821712-2.

JAMAL, AHMAD
AT THE PERSHING, Vogue, 6000 49.

JAMES, HARRY
CRAZY RHYTHM, Polygram, 823229-2; GOLDEN TRUMPET OF HARRY JAMES, Polygram, 820178-2; THE KING JAMES VERSION, Sheffield Lab, CD-3.

JAPAN
EXORCISING GHOSTS, EMI, VGDCD 3510; OIL OF CANVAS, EMI, CDVC 2513.

JAPANESE MUSIC
NIPPON DAIKO NO MIRYOKU, Denon, C33-7030; THE WORLD OF SHAMISEN, Denon, C33-7019; THE WORLD OF SO, Denon, C33-7020.

JARRE, JEAN-MICHEL
CONCERTS IN CHINA, Polygram, 811551-2; EQUINOXE, Polygram, 800025-2; ESSENTIAL JEAN-MICHEL JARRE, Polygram, 817003-2; MAGNETIC FIELDS, Polygram, 800024-2; OXYGENE, Polygram, 800015-2; ZOOLOOK, Polygram, 823763-2.

JARREAU, AL
BREAKIN' AWAY, Warner, 03576-2; HIGH CRIME, Warner, 25106-2; JARREAU, Warner, 50070-2.

JARRETT, KEITH
ARBOUR ZENA, ECM, 825 592-2; CHANGES, ECM, 817 436-2; CONCERTS (BREGENZ), ECM, 827 286-2; EYES OF THE HEART, ECM, 825 476-2; INVOCATIONS/THE MOTH & THE FLAME, ECM, 825 473-2; MY SONG, ECM, 821 406-2; SPHERE, ECM, 827 463-2; STAIRCASE, ECM, 827 337-2; STANDARDS Vol 2, ECM, 825 015-2; STANDARDS Vol 1, ECM, 811 966-2; THE KOLLN CONCERT, ECM, 810 067-2; THE SURVIVOR'S SUITE, ECM, 827 132-2; WORKS SERIES, ECM, 825 425-2.

JARRETT, SCOTT
WITHOUT RHYME OR REASON, GRP, D9518.

JAZZTET, THE
MOMENT TO MOMENT, Soul Note, SN 1066CD.

JEFFERSON STARSHIP
NUCLEAR FURNITURE, RCA, PCD14921.

JENNINGS, WAYLON
WWII — with Willie Nelson, RCA, PCD14455.

JESSE JOHNSON REVUE
JESSE JOHNSON REVUE, Festival, CD 38423.

JOEL, BILLY
52ND STREET, CBS, CDCBS83181; AN INNOCENT MAN, CBS, CDCBS25554; GLASS HOUSES, CBS, CDCBS86108; PIANO MAN, CBS, CDCBS80719; THE NYLON

JOHN, ELTON
21 AT 33, Polygram, 800055-2; BREAKING HEARTS, Polygram, 822028-2; FOX, Polygram, 800063-2; JUMP UP, Polygram, 800037-2; LOVE SONGS, Polygram, 811312-2; TOO LOW FOR ZERO, Polygram, 811052-2.

JONES, JO
OUR MAN, PAPA JO! Denon, C38-7047.

JONES, HOWARD
DREAM INTO ACTION, WEA, 240632-2; HUMAN'S LIB, Elektra/Asylum, 60346-2.

JONES, QUINCY
BEST OF, FESTIVAL, CD 37763; GREAT WIDE WORLD OF, Polygram, 822470-2; THE DUDE, Festival, CD 37569.

JONES, RICKIE LEE
PIRATES, Warner. 3432-2; RICKIE LEE JONES, Warner, 03296-2; THE MAGAZINE, Warner, 25117-2.

JONES, TOM
BEST OF, Polygram, 3122-21; DARLIN' Polygram, 818814-2; GREAT BALLADS, Polygram, 820206-2; GREEN GREEN GRASS OF HOME, Polygram, 820182-2.

JOPLIN, JANIS
PEARL, CBS, CDCBS64188.

JORDON, STANLEY
MAGIC TOUCH, EMI, 746092.

JOURNEY
FRONTIERS, CBS, CDCBS25261.

JUDAS PRIEST
DEFENDERS OF THE FAITH, CBS, CDCBS2571.

KAEMPFERT, BERT
BEST OF, Polygram, 823702-2; FAMOUS SWING CLASSICS, Polygram, 817816-2; LIVE IN LONDON, Polygram, 82544-2; SPANISH EYES, Polygram, 800107-2; SWINGING SAFARI, Polygram, 825494-2; UNIVERGESSENE MELODIENE, Polygram, 815710-2.

KANE GANG
BAD AND LOWDOWN WORLD, Polygram, 820215-2.

KANSAS
BEST OF KANSAS, CBS, CDEPC26065.

KENNEDY, N & PETTINGER, P
STRAD JAZZ, Chandos, CHAN-8350.

KERSHAW, NIK
HUMAN RACING, MCA, 104-2; THE RIDDLE, MCA, 106-2.

KHAN, CHAKA
I FEEL FOR YOU, Warner, 25162-2.

KIDS IN THE KITCHEN
SHINE, Festival, CD 53168

KILLING JOKE
NIGHT TIME, Polygram, 825244-2.

KING CRIMSON
BEAT, Polygram, 821194-2; DISCIPLINE, Polygram, 800099-2; IN THE COURT OF THE CRIMSON KING, Polygram, 800030-2; THREE OF A PERFECT PAIR, Polygram, 817882-2.

KING, CAROLE
SPEEDING TIME, Atlantic, 801182.

KINKS
GREATEST HITS, Polygram, CDKINK 7251

KISS
ANIMALIZE, Polygram, 822495-2; LICK IT UP, Polygram, 814297-2; UNMASKED, Polygram, 800041-2.

KITARO
ASIA TOUR SUPER LIVE, Polygram, 3142-10; FROM THE FULL MOON STORY, Polygram, 810945-2; KITARO, Polygram, 3142-1; LIVE IN ASIA, Polygram, 825204-2; OASIS, Polygram, 815340-2; SILK ROAD, Polygram, 823736-2; SILVER CLOUD, Polygram, 817560-2.

KLUGH, EARL
HOTEL CALIFORNIA, Polygram, 814724-2; LOW RIDE, EMI, 746007; SODA FOUNTAIN SHUFFLE, Warner, 25262-2; WISHFUL THINKING, EMI, 746030.

KNEF, HILDEGARD
THE LADY IS A TRAMP, Teldec, 8.26.143.ZP.

KNOPFLER, MARK
CAL, Polygram, 822769.2; MUSIC FROM LOCAL HERO, Polygram, 811038-2.

KOOL AND THE GANG
IN THE HEAT, Polygram, DECD8508.

LAMBERT, FRANZ
LET'S HAVE A PARTY, Teldec, 8.25.953.ZP; SYMPHONIE d'AMOUR, Teldec, 8.25.400.ZP.

LANTIER JACK
JACK LANTIER, Vogue, 6000 10.

LAST, JAMES
ALL ABOARD WITH CAP'N JAMES, Polygram, 821612-2; BISCAYA, Polygram, 811516-2; CHRISTMAS CLASSICS, Polygram, 815446-2; CLASSICS, Polygram, 800017-2; CLASSICS UP TO DATE Vol 1, Polygram, 821122-2; CLASSICS UP TO DATE Vol 2, Polygram, 821109-2; CLASSICS UP TO DATE Vol 3, Polygram, 821110-2; CLASSICS UP TO DATE Vol 4, Polygram, 821111-2; CLASSICS UP TO DATE Vol 5, Polygram, 821115-2; CLASSICS UP TO DATE Vol 6, Polygram, 821159-2; GAMES THAT LOVERS PLAY, Polygram, 821610-2; HAMMON A GO GO, Polygram, 821586-2; HAPPY LEHAR, Polygram, 821609-2; IN CONCERT, Polygram, 821613-2; IN RUSSIA, Polygram, 821113-2; IN THE ALPS, Polygram, 821995-2; IN THE MOOD FOR TRUMPETS, Polygram, 821112-2; NON STOP DANCING '83, Polygram, 810783-2; NON STOP DANCING '85, Polygram, 825115-2; PARADIESVOGEL, Polygram, 811517-2; PARADISO, Polygram, 823345-2; PLAYS BEATLES' GREATEST SONGS, Polygram, 815691-2; PLAYS ROBERT STOLTZ, Polygram, 821114-2; POLKA PARTY, Polygram, 821614-2; REFLECTIONS, Polygram, 815354-2; ROMANTIC DREAMS, Polygram, 800033-2; ROSEN AUS DEM SUDEN, Polygram, 821116-2; TANGO, Polygram, 800016-2; TRAUM WAS SCHONES, Polygram, 811518-2; TRUMPET A GO GO, Polygram, 821587-2; WESTERN PARTY, Polygram, 823840-2.

LAUPER, CYNDI
SHE'S SO UNUSUAL, DBS, CDPRT25792.

LAWRENCE, SYD AND ORCHESTRA
BIG BAND SWING, Polygram, 814356-2.

LEAGUE UNLIMITED ORCHESTRA
LOVE AND DANCING, EMI, CDOVED 6.

LED ZEPPELIN
HOUSES OF THE HOLY, Atlantic, 19130-2; IN THROUGH THE OUT DOOR, Atlantic, 16002-2; LED ZEPPELIN, Atlantic, 19129-2; LED ZEPPELIN II, Atlantic, 19127-2.

LEFEVRE, RAYMOND
DEMOPNSTRATION, Polygram, 810021-2; OPERMANIA, Polygram, 810058-2.

LENNON, JOHN
MILK AND HONEY, Polygram, 817160-2.

LENNON, JULIAN
VALOTTE, EMI, JLCD 1.

LEVEL 42
PURSUIT OF ACCIDENTS, Polygram, 810015-2; TRUE COLOURS, Polygram, 823542-2.

LEWIS, JERRY LEE
20 GREATEST HITS, Bellaphon, 290.13.002; SESSION, Polygram, 822751-2.

LITTLE RIVER BAND
GREATEST HITS, EMI, 746021; PLAYING TO WIN, EMI, 746061.

STORY, LIZ
SOLID COLOURS, Festival, CD 39867.

LOOSE ENDS
SO WHERE ARE YOU, EMI, CDV 2340.

LOPEX, TRINI
GOODIES, Bellaphon, 288.07.003.

LOS FRONTERIZOS
MISA CRIOLLA, Polygram, 814055-2.

LOUDNESS
DISILLUSION, Denon, C38-7134.

M'BOOM
COLLAGE, Soui Note, SN 1059CD.

MACDONALD, RALPH
UNIVERSAL RHYTHM, Polygram, 823323-2.

MACDOWELL, LENNY
BALANCE OF POWER, Bellaphon CDB16230.

MADONNA
LIKE A VIRGIN, Warner, 25157-2; MADONNA, Warner, 238672.

MAFFAY, PETER
1000 DREAMS AWAY, Teldec, 8.25.935.ZP.

MAKOWICZ, Adam
THE NAME IS MAKOWICZ, Sheffield Lab, CD-21.

MALANDO AND HIS TANGO ORCH
UNFORGETTABLE TANGOS, Polygram, 824207-2.

MALMSTEEN, INGWIE
MARCHING OUT, Polygram, 825733-2; RISING FORCE, Polygram, 825324-2.

MANCINI, HENRY
MAMMA (FAMOUS ITALIAN SONGS), Polygram, 411959-2; PURE GOLD, RCA, PCD13667.

MANGIONE, CHUCK
LAND OF MAKE BELIEVE, Polygram, 822539-2.

MANHATTAN TRANSFER
BEST OF MANHATTAN TRANSFER, Atlantic, 80085-2; BODY AND SOULS, Atlantic, 80104-2; BOP DOO-WOP, Atlantic, 81233-2; VOCALESE, Atlantic, 81266-2.

MANTOVANI
GOLDEN HITS, Polygram, 800085-2; IMMORTAL CLASSICS, Polygram, 3122-6; MEMORIES, Polygram, 820181-2; MORE MANTOVANI, Polygram, 820037-2; OPERETTA MEMORIES, Polygram, 3122-10; STRAUSS WALTZES, Polygram, 3122-9; VERY THOUGHT OF YOU, Polygram, 820189-2.

MARIA, TANIA
COME WITH ME, Festival, CD 39600; THE REAL TANIA, Festival, CD 39664.

MARILLION
FUGAZI, EMI, 746027; MISPLACED CHILDHOOD, EMI, 746160.

MARILYN
DESPITE STRAIGHT LINES, Polygram, 818645-2.

MARLEY, BOB & THE WAILERS
BOB MARLEY AND THE WAILERS, Bellaphon, 290.07.002.

MATHEWS, DAVID ORCHESTRA
DELTA LADY — featuring Earl Klugh, Bellaphon, 290.18.003.

MAURIAT, PAUL
BEST OF, Polygram, 810025-2; BEST OF VOL 1, Polygram, 818967-2; BEST OF Vol 2, Polygram, 818968-2; FILM THEMES Vol 1, Polygram, 818969-2; FILM THEMES Vol 2, Polygram, 818970-2; I LOVE BREEZE, Polygram, 811170-2; MAGIC, Polygram, 810012-2, SEVEN SEAS, Polygram, 818781-2; TRANSPARENCE, Polygram, 824557-2.

MAYALL, JOHN
BLUES BREAKERS, Polygram, 800086-2.

MAYORGA, LINCOLN
THE MISSING LINC, Sheffield Lab, CD-S10.

McARTNEY, PAUL
GIVE MY REGARDS TO BROAD STREET, EMI, 746043; PIPES OF PEACE, EMI, 746018; TUG OF WAR, EMI, 746057; BAND ON THE RUN, EMI, 746055; WINGS' GREATEST, EMI, 746056.

McBROOM, AMANDA & LINCOLN MAYORGA
GROWING UP IN HOLLYWOOD TOWN, Sheffield Lab, CD-13; WEST OF OZ, Sheffield Lab, CD-15.

McCANDLESS, PAUL
OREGON, ECM, 811 711-2.

McDONALD, MICHAEL
IF THAT'S WHAT IT TAKES, Warner, 23703-2; NO LOOKIN' BACK, Warner, 25291-2.

McLAREN, MALCOLM
FANS, EMI, MMDCD 2.

McLAUGHLIN, JOHN
PASSION, GRACE AND FIRE, Polygram, 811334-2.

McVIE, CHRISTINE
CHRISTINE McVIE, Warner, 25059-2.

MEATLOAF
BAT OUT OF HELL, CBS, CDEPC82419.

MEN AT WORK
BUSINESS AS USUAL, CBS, CDCBS85423; CARGO, CBS, CDCBS25372.

MEN WITHOUT HATS
FOLK OF THE '80s, PART 3, EMI, CDST 18; RHYTHM OF YOUTH, EMI, CDST 10.

MENDES, SERGIO
CONFETTI, Festival, CD 38152.

MERRILL, HELEN
HELEN MERRILL & CLIFFORD BROWN, Polygram, 814643-2.

METHENY, PAT
80/81, ECM, 815 579-2; AMERICAN GARAGE, ECM, 827 134-2; BRIGHT SIZE LIFE, ECM, 827 133-2; FIRST CIRCLE, ECM, 823 342-2; NEW CHAUTAUQUA, ECM, 825 471-2; OFFRAMP, ECM, 817 138-2; PAT METHENY GROUP, ECM, 825 593-2; REJOICING, ECM, 817 795-2; WATER COLOURS, ECM, 827 409-2; AS FALLS WICHITA, SO FALLS WICHITA, ECM, 821 416-2.

MIAMI SOUND MACHINE
EYES OF INNOCENCE, CBS, CDEPC26167.

MIDLER, BETTE
NO FRILLS, Atlantic, 80070-2; THE DIVINE MISS M, Atlantic, 7238-2.

MILLER, GLENN ORCHESTRA
IN THE DIGITAL MOOD, GRP, D9502.

MILLER, STEVE BAND
ABRACADABRA, Polygram, 800090-2; GREATEST HITS, Polygram, 800058-2; ITALIAN X-RAYS, Polygram, 822823-2; LIVE, Polygram, 811020-2.

MILLS, STEPHANIE
I'VE GOT THE CURE, Polygram, 822421-2.

MILSAP, RONNIE
INSIDE RONNIE MILSAP, RCA, PCD14311; IT WAS ALMOST LIKE A SONG, RCA, PCD12439; KEYED UP, RCA, PCD14670; THERE'S NO GETTING OVER ME, RCA, PCD14060.

MINGUS, CHARLES
PLAYS MINGUS FAVOURITES, Denon, 7677.

MITCHELL, JONI
COURT AND SPARK, Elektra/Asylum, 61001-2.

MIYANO, HIROKO
HOTEL CALIFORNIA, Polygram, 814724-2.

MODERN JAZZ QUARTET
LONGING FOR THE CONTINENT, Denon, 7678; REUNION AT BUDOKAN 1981, Warner, 251210-2.

MONDO ROCK
UP TO THE MOMENT, Polgram, 825597-2.

MONK, MEREDITH
DOLMEN MUSIC, ECM, 825 459-2.

MONK, THELONIUS
EUROPEAN TOUR — with Max Roach, Denon, 7683.

MONROE, MARILYN
GOODBYE PRIMADONNA, AZ DISC, 339372.

MONTGOMERY, WES
BUMPIN', Polygram, 821985-2; DYNAMIC DUO, Polygram, 821577-2; GOIN' OUT OF MY HEAD, Polygram, 825676; MOVIN' WES, Polygram, 810045-2; SILVER COLLECTION, Polygram, 823448-2.

MOODY BLUES
BEST OF MOODY BLUES, Polygram, 820155-2; PRESENT, Polygram, 810199-2.

MOORE, DUDLEY
PETER AND THE WOLF, Polygram, 412556-2.

MOORE, GARY
CORRIDORS OF POWER, EMI, CDV 2245; VICTIMS OF THE FUTURE, EMI, DIXCD 25680-2.

MORRISON, VAN
BEAUTIFUL VISION, Polygram, 800036; INARTICULATE SPEECH OF THE HEART, Polygram, 811140-2; INTO THE MUSIC, Polygram, 800057-2; LIVE AT THE GRAND OPERA HOUSE, BELFAST, Polygram, 818336; MOONDANCE, Warner, 3103-2; SENSE OF WONDER, Polygram, 822895-2; TB SHEETS, Bellaphon, 288.07.001.

MORSE, STEVE BAND
THE INTRODUCTION, Elektra/Asylum, 60369-2.

MORTON, JELLY ROLL
NEW ORLEAN MEMORIES, Teldec, 8.24.062.ZP.

MOSCH, ERNST
GOLDEN MUSIC FROM THE EGERLAND, Teldec, 8.25.765.ZP; SONGS FOR US, Teldec, 8.25.501.ZP.

MOTIAN, PAUL TRIO
IT SHOULD'VE HAPPENED A LONG TIME AGO, ECM, 823 641-2.

MOTLEY CRUE
SHOUT AT THE DEVIL, Elektra/Asylum, 60289-2; THEATRE OF PAIN, Elektra/Asylum, 60418-2.

MOUNTAIN
GO FOR YOUR LIFE, Bellaphon, 290.14.032.

MOUSKOURI, NANA
ATHENA, Polygram, 818111-2; BALLADES, Polygram, 810013-2; NANA, Polygram, 810055-2; NANA, Polygram, 818622-2; SONGS FOR LIBERTY, Polygram, 810005-2.

MOUSTAKI, GEORGE
LE METEQUE, Polygram, 810521-2.

MOYET, ALISON
ALF, CBS, CDCBS26229.

MUELLER, WERNER
GOLDEN SOUND OF WERNER MUELLER, Teldec, 8.25.779.ZP; SALUTES THE KINDS OF SWING, Teldec, 8.26.145.ZP.

MULLER, EDUARDO
O SOLE MIO — ITALIAN SONGS, Polygram 400015-2.

MULLIGAN, GERRY
LITTLE BIG HORN, GRP, D9503; MULLIGAN, Denon, 7682; NIGHT LIGHTS, Polygram, 818271-2; THE FABULOUS GERRY MULLIGAN QUARTET, Vogue, 6000 28.

MURRAY, ANNE
GREATEST HITS, EMI, 746058; HEART OVER MIND, EMI, 746059.

MURRAY, DAVID BIG BAND
LIVE AT SWEET BASIL Vol 1, Black Saint, BSR 0085CD.

MURRAY, DAVID OCTET
HOME, Black Saint, BSR 0055CD; MING, Black Saint, BSR 0045CD; MORNING SONG, Black Saint, BSR 0075CD.

NATIONAL PERCUSSION GROUP OF KENYA
ROOTS!! AFRICAN DRUMS, Denon, C39-7276.

NAZARETH
GREATEST HITS, Polygram, 824427-2.

NELSON, WILLIE
WWII — with Waylon Jennings, RCA, PCD14455.

NENA
FRAGEZEICHEN, CBS, CDCBS25870.

NEW AIR
LIVE AT MONTREAL, Black Saint, BSR 0084CD.

NEW EDITION
NEW EDITION, MCA, 5515-2.

NEWMAN, RANDY
TROUBLE IN PARADISE, Warner, 23755-2.

NEWTON, JAMES
ECHO CANYON, Celestial Harmonies, CEL012.

NICKS, STEVIE
BELLA DONNA, Warner, 2-99169; THE WILD HEART, Warner, 500712.

NICOLE
GREATEST HITS, Teldec, 8.25.792.ZP.

NIGHT RANGER
MIDNIGHT MADNESS, MCA, 5456-2.

NORDISLE BOIS ORCHESTRA
LOVE-SOUND-BREAK, Denon, C38-7206.

NORIS, GUNTER
BELLA ITALIA, Teldec, 8.25.485.ZP; DANCE RECORD OF THE YEAR 1984, Teldec, 8.25.601.ZP; DANCE RECORD OF THE YEAR 1985, Teldec, 8.25.934.ZP; FESTIVAL TROPICAL, Teldec, 8.26.032.ZP; STEP INTO GUNTER'S PIANO BAR, Teldec, 8.25.769.ZP.

NORMAN, JESSYE
WITH A SONG IN MY HEART, Polygram, 412625-2.

OAK RIDGE BOYS
GREATEST HITS 2, MCA, 5496-2.

OCEAN, BILLY
SUDDENLY, EMI, CHIP 12.

ODESSA BALALAIKAS
THE ART OF THE BALALAIKA, WEA, 79034-2.

OHARA, SHIGENORI
TONIGHT WE LOVE, Denon, C32-7098.

OHNO, ERI
EASY TO LOVE — with Great Jazz Trio, Denon, C38-7085; ERI, MY DEAR, Denon, C38-7016.

OLDFIELD, MIKE
CRISIS, EMI, CDV 2262; DISCOVERY, EMI, CDV 2328; FIVE MILES OUT, EMI, CDV 2222; HERGEST RIDGE, EMI, CDV 2013; KILLING FIELDS — soundtrack, EMI, CDV 2328; OMMADAWN, EMI, CDV 2043; PLATINUM, EMI, CDV 2141; Q.E.2, EMI, CDV 2181; TUBULAR BELLS, EMI, CDV 2001.

ONO, YOKO
MILK AND HONEY, Polygram, 817160-2.

ORCHESTRAL MANOEUVRES IN THE DARK
ARCHITECTURE AND MORALITY, EMI, CDID 12; CRUSH, EMI, CDV 2349; DAZZLESHIPS, EMI, CDV 2261; JUNK CULTURE, EMI, CDV 2310; ORCHESTRAL MANOEUVRES IN THE DARK, EMI, DIDCD 2.

OREGON
CROSSING, ECM, 825 323-2.

OTTE, HANS
BOOK OF SOUNDS, Kuckuck, CD069-70.

PAPETTI, FAUSTO
MIDNIGHT MELODIES, Vogue, 6000 60; MY ONE AND ONLY LOVE, Durium, CD 6000 16; MY ONE AND ONLY LOVE, Vogue, 600016; US AND THEM, Vogue, CD9501; US AND THEM, Durium, CD 9501.

PARR, JOHN
JOHN PARR, Polygram, 824491-2.

PASSPORT
RUNNING IN REAL TIME, WEA, 240633-2.

PEACOCK/JARRETT/DE JOHNETTE
TALES OF ANOTHER, ECM, 827 418-2.

PENDERGRASS, TEDDY
LOVE LANGUAGE, Elektra/Asylum, 60317-2.

PERRY, STEVE
STREET TALK, CBS, CDCBS25967.

PETERSON, OSCAR
BURSTING OUT, Polygram, 821986-2; NIGHT TRAIN, Polygram, 821724-2; SILVER COLLECTION, Polygram, 823447-2; TRIO AND ONE, Polygram, 818840-2; WE GET REQUESTS, Polygram, 810047-2; WEST SIDE STORY, Polygram, 821575-2.

PHIL OAKEY AND GIORGIO MORODER
PHIL OAKEY & GIORGIO MORODER, EMI, CDV 2351.

PINK FLOYD
DARK SIDE OF THE MOON, EMI, 746001; MEDDLE, EMI, 746034.

PINK PROJECT
SPLIT, Ultraphone, 8.25729.

PLANT, ROBERT
SHAKIN' AND STIRRED, Atlantic, 90265-2; THE PRINCIPLE OF MOMENTS, Atlantic, 90101-2.

POLICE
ZENYATTA MONDATTA, Festival, CD 37377.

PONTY, JEAN-LUC
INDIVIDUAL CHOICE, Polygram, 817189-2; OPEN MIND, Polygram, 823581-2; MYSTICAL ADVENTURES, Atlantic, 19333-2.

POURCEL, FRANK
IN A NOSTALGIC MOOD, EMI, 746017.

POWELL, ANDREW
BEST OF ALAN PARSONS PROJECT, EMI, 746006.

POWELL, BUD TRIO
PARIS-NEW YORK, Vogue, 6000 46.

PRESLEY, ELVIS
ELVIS, RCA, PCD15199; ELVIS PRESLEY, RCA, PCD15198; MERRY CHRISTMAS, RCA, PCD15301.

PRINCE
1999, Warner, 23720-2; CONTROVERSY, Warner, 3601-2; DIRTY MIND, Warner, 3478-2; AROUND THE WORLD IN A DAY, Warner, 25286-2; PURPLE RAIN, Warner, 25110-2.

PURPLE RAIN
CAFE BAR MUSIC, Denon, 7399.

QUARTERFLASH
QUARTERFLASH, CBS, CDGEF85438; TAKE ANOTHER PICTURE, CBS, CDGEF25507.

QUEEN
A NIGHT AT THE OPERA, Elektra-Asylum, 1053-2; GREATEST HITS, Elektra/Asylum, 564-2; NEWS OF THE WORLD, Elektra/Asylum, 112-2; SHEER HEART ATTACK, Elektra-Asylum, 1026-2; THE GAME, Elektra/Asylum, 64513-2; THE WORKS, EMI, 746016.

RABBITT, EDDIE
STEP BY STEP, Polygram, 800046-2.

RAFFERTY, GERRY
CITY TO CITY, EMI, 746049.

RAINBOW
BENT OUT OF SHAPE, Polygram, 815305-2; GREATEST HITS, Polygram, 800074-2; STRAIGHT BETWEEN THE EYES, Polygram, 800028-2.

RAINDANCER
LITTLE BIT CONFUSED, Bellaphon, 270.09.061.

RATT
INVASION OF YOUR PRIVACY, Atlantic, 81257-2; OUT OF THE CELLAR, Atlantic, 80143-2.

REHMANN, BENNY
DREAMLAND, Polygram, 818915-2.

REICH, STEVE
MUSIC FOR 18 MUSICIANS, ECM, 821 417-2; OCTET MUSIC FOR LARGE ENSEMBLE, ECM, 827 287-2; TEHILLIM, ECM, 827 411-2.

REINHARDT, DJANGO
DJANGO REINHARDT & STEPHANE GRAPPELLI, Vogue, 6000 70.

REO SPEEDWAGON
WHEELS ARE TURNIN', CBS, CDEPC26137.

RICHARD, CLIFF
SILVER, EMI, 746008.

RIGHEIRA
NO TENGO DINERO: Disco Music, Teldec, 8.25.680.ZP.

RIGHTEOUS BROTHERS
GREATEST HITS, Polygram, 823119-2.

RITENOUR, LEE
ON THE LINE, GRP, D9525; RIO, Elektra/Asylum, 60024-2; RIO, GRP, D9524.

RIVERS, MAVIS
IT'S A GOOD DAY, Delos, 4002.

ROACH, MAX
AT BASIN STREET, Polygram, 814648-2; EASY WINNERS, Soul Note, SN 1109CD; EUROPEAN TOUR — with Thelonius Monk, Denon, 7683; MORE STUDY IN BROWN, Polygram, 814637-2; SCOTT FREE, Soul Note, SN 1103CD; STUDY IN BROWN, Polygram, 814646-2; SURVIVORS, Soul Note, SN 1093CD.

RODGERS, NILE
B-MOVIE MATINEE, Warner, 25290-2.

ROGERS, KENNY
GREATEST HITS, EMI, 746004.

ROLLING STONES
AFTERMATH, Polygram, 820050-2; BEGGERS BANQUET, Polygram, 800084-2; BETWEEN THE BUTTONS, Polygram, 820138-2; HOT ROCKS 1, Polygram, 820141-2; HOT ROCKS 2, Polygram, 820142-2; LET IT BLEED, Polygram, 820052-2; OUT OF OUR HEADS, Polygram, 820049-2; ROLLING STONES, Polygram, 820047-2; ROLLING STONES 12 × 5, Polygram, 820048-2; UNDERCOVER, EMI, 746024.

ROLLINS, SONNY
BRASS TRIO, Polygram, 815056-2.

RONSTADT, LINDA
GET CLOSER, Elektra/Asylum, 60185-2; GREATEST HITS, Elektra/Asylum, 64106-2; GREATEST HITS VOLUME II, Elektra/Asylum, 5162; LUSH LIFE, Elektra/Asylum, 60387-2; WHAT'S NEW, Elektra/Asylum, 60260-2.

ROS,EDMUNDO
EDMUNDO ROS' LATIN WORLD, Polygram, 3122-2; HEATH VERSUS ROS, Polygram, 3122-4; LATIN MAGIC, Polygram, 820214-2; LATIN MEMORIES OLD AND NEW, Polygram, 810120-2.

ROSS, DIANA
SWEPT AWAY, EMI, 746053; WHY DO FOOLS FALL IN LOVE?, EMI, 746023.

ROSSI, NINO
IL SILENZIO, Vogue, 6000 22.

ROUSSOS, DEMIS
DEMIS, Polygram, 800040-2; GREATEST HITS, Polygram, 814212-2.

ROXY MUSIC
ATLANTIC YEARS 1973-1980, Polygram, 815849-2; AVALON, Polygram, 800032-2; COUNTRY LIFE, Polygram, 823147-2; FLESH AND BLOOD, Polygram, 800019-2; FOR YOUR PLEASURE, Polygram, 823018-2; MANIFESTO, Polygram, 800031-2; ROXY MUSIC, Polygram, 821522-2; SIREN, Polygram, 823020-2; STRANDED, Polygram, 823019-2.

RUBBER RODEO
SCENIC VIEWS, Polygram, 818477-2.

RUSH
GRACE UNDER PRESSURE, Polygram, 818476-2.

RUSSELL, GEORGE
LIVE IN AN AMERICAN TIME SPIRAL, Soul Note, SN 1049CD.

RYPDAL, TERJE
CHASER, ECM, 827 256-2; WORKS SERIES, ECM, 825 428-2.

RYPDAL/VITAS/DEJOHNETTE
SUNRISE, SEASONS, ETC., ECM, 825 470-2.

SADE
DIAMOND LIFE, CBS, CDEPC26044.

SAKAMOTO, RYUICHI
THE END OF ASIA, Denon, C38-7045; THOUSAND KNIVES OF RYUICHI SAKAMOTO, Denon, C38-7137.

SALUZZI, DINO
KULTRUM, ECM, 821 40702.

SANBORN, DAVID
STRAIGHT TO THE HEART, Warner, 25150-2; VOYEUR, Warner, 35462.

SANTANA
ABRAXAS, CBS, CDCBS64087; BEYOND APPEARANCES, CBS, CDCBS86307; GREATEST HITS, CBS, CDCBS69081; SHANGO, CBS, CDCBS85914; ZEBOP, CBS, CDCBS84946.

SASSONE, FLORINDO
BEST OF, Polygram, 3112-30.

SAWAD, SHUNGO
SJUNGO, Denon, C38-7208.

SCHIMMEL
TANGO PROJECT, WEA, 79030-2.

SCHNUCKENACK REINHARDT QUINTET
SWINGIN' WITH, Polygram, 824190-2.

SCHUUR, DIANE
DEEDLES, GRP, D9510.

SCORPIONS
LOVE AT FIRST STING, EMI, 746025.

SCOTT, TOM
DESIRE, Elektra/Asylum, 60162-2; TARGET, Atlantic, 80106-2.

SCOTT, TONY
MUSIC FOR ZEN MEDITATION, Polygram, 817209-2.

SCRITTI POLITTI
CUPID AND PSYCHE, EMI, CDV 2350.

SEGER, BOB
AGAINST THE WIND, EMI, 746060; LIVE BULLET, EMI, 746085; STRANGER IN TOWN, EMI, 746074; THE DISTANCE, EMI, 746005.

SHAKATAK
DOWN ON THE STREET, Polygram, 823304-2; DRIVIN' HARD, Polygram, 823017-2; INVITATIONS, Polygram, 810068-2; LIVE IN JAPAN, Polygram, 823899-2; NIGHT BIRDS, Polygram, 810829-2; OUT OF THIS WORLD, Polygram, 815304-2.

SHAKIN' STEVENS
THE BOP WON'T STOP, CBS, CDEPC86301.

SHALAMAR
FRIENDS, WEA, S-28-2.

SHANKAR
WHO'S TO KNOW, ECM, 827 269-2.

SHANKAR/GARBAREK/HUSSAIN/GURTU
SONG FOR EVERYONE, ECM, 823 795-2.

SHANNON
LET THE MUSIC PLAY, Bellaphon, 290.19.001.

SHARPE, BILL
FAMOUS PEOPLE, Polygram, 825497-2.

SHARPLES, BOB
AMERICA ON THE MARCH, Polygram, 820176-2.

SHAW, TOMMY
GIRLS WITH GUNS, Festival, CD 38243.

SHEARING, GEORGE
AN EVENING WITH, Festival, CD 39590.

SHEPP, ARCHIE
BALLADS FOR TRANE, Denon, C38-7264; DOWN HOME NEW YORK, Soul Note, SN 1102CD; FAMILY OF PERCUSSION, Bellaphon, CDMIX 1021; ON GREEN DOLPHIN STREET, Denon, C38-7262.

SHEPP, ARCHIE & DOLLAR BRAND
DUET, Denon, C38-7008.

SHEW, BOBBY & CHUCK FINDLEY
TRUMPETS NO END, Delos, 4003.

SIMON & GARFUNKEL
BOOKENDS, CBS, CDCBS63101; BRIDGE OVER TROUBLED WATER, CBS, CDCBS63699; PARSLEY, SAGE, ROSEMARY & THYME, CBS, CDCBS62825; SOUNDS OF SILENCE, CBS, CDCBS62690; THE GRADUATE SOUNDTRACK, CBS, CDCBS70042; THE SIMON AND GARFUNKEL COLLECTION, CBS, CDCBS24005; WEDNESDAY MORNING 3AM, CBS, CDCBS63370.

SIMON, CARLY
HELLO BIG MAN, Warner, 23886-2; THE BEST OF CARLY SIMON, Atlantic, 80109-2.

SIMON, PAUL
GREATEST HITS, CBS, CDCBS86047; HEARTS AND BONES, Warner, 239442; STILL CRAZY, CBS, CDCBS86001.

SIMPLE MINDS
NEW GOLDEN DREAM, EMI, CDV 2230; SPARKLE IN THE RAIN, EMI, CDV 2300.

SIOUXSIE AND THE BANSHEES
HYAENA, Polygram, 821510-2.

SKYHOOKS
LIVING IN THE '70s, Festival, CD 53142.

SLEDGE, PERCY
GREATEST HITS, Bellaphon, 288.07.004.

SMITH, JIMMY
BASHIN' Polygram, 823308-2; CAT, Polygram, 810046-2; DYNAMIC DUO, Polygram, 821577-2; OFF THE TOP, Elektra/Asylum, 601752; ORGAN GRINDERS SWING, Polygram, 825675-2; THE SERMON, EMI, 746097; WHO IS AFRAID OF VIRGINIA WOOLF, Polygram, 823309-2.

SOUNDTRACKS
ADVENTURES OF A YOUNG MAN, Southern Cross, LXCD1; ADVENTURES OF ROBIN HOOD — Korngold, Varese Sarabande, 47202; AGAINST ALL ODDS, Atlantic, 80152-2; BEAT STREET, Atlantic, 80154-2; BEN HUR — Miklos Rozsa, Polygram, 820190-2; BEST OF TWILIGHT ZONE, Vol 1, Varese Sarabande, 47233; BEVERLY HILLS COP, MCA, 5553-2; DAS BOOT — Klaus Doldinger, WEA, 240581-2; BREAKDANCE, Polygram, 821919-2; BREAKFAST CLUB, Festival, CD 38325; CAL — Mark Knopfler, Polygram, 822769-2; CHARIOTS OF FIRE — Vangelis, Polygram, 800020-2; CLOCKWORK ORANGE, Warner, 25732; COUNTRY, Festival, CD 39036; DIVA — Vladimir Cosma, Milan, CD 061; DREAMSCAPE — Maurice Jarre, Sonic Atmospheres, CD302; DUNE, Polygram, 823770-2; ELECTRIC DREAMS, EMI, CDV 2318; EMPIRE STRIKES BACK — John Williams, Varese Sarabande, 47204; ESCAPE FROM NEW YORK — Carpenter, Varese Sarabande, 47224; FAME, Polygram, 800034-2; FLASHDANCE, Polygram, 811492-2; FORT SAGANNE — Phillipe Sarde, Milan, CD 238; FLASHDANCE — Donna Summer, Polygram, 811492-2; GHOSTBUSTERS, Festival, CD 53140; THE GRADUATE — Simon & Garfunkel, CBS, CDCBS70042; GREYSTOKE — THE LEGEND OF TARZAN, Warner, 25120-2; HALLOWEEN — Carpenter, Varese Sarabande, 47230; HITCHCOCK FILMS, Varese Sarabande, 47225; INDIANA JONES AND THE TEMPLE OF DOOM, Polygram, 821592-2; KILLING FIELDS — Mike Oldfield, EMI, CDV 2328; KINGS ROW — Eric Korngold, Varese Sarabande, 47203; LES MUSIQUES DES FILMS DE CHARLIE CHAPLIN, Vogue, 6000 09; LOCAL HERO — Mark Knopfler, Polygram, 811038-2; METROPOLIS, CBS, CDCBS70252; MAN FROM SNOWY RIVER, Festival, CD 37773; MIDNIGHT EXPRESS, Polygram, 824206-2; MUSIC OF MIKLOS ROZSA, Varese Sarabande, 47226; MY FAIR LADY, CBS, CDCBS70000; NORTH BY NORTH-WEST, Varese Sarabande, 47205; ONCE UPON A TIME IN AMERICA, Polygram, 818697-2; QUO VADIS — Miklos Rozsa, Polygram, 820200-2; PURPLE RAIN — Prince, Warner, 25110-2; RAIDERS OF THE LOST ARK, Polygram, 821583-2; RAMBO — FIRST BLOOD — Goldsmith, Varese Sarabande, 47234; THE ROSE — Bette Midler, Atlantic, 16010-2; RUNAWAY — Goldsmith, Varese Sarabande, 47221; SECRET OF THE NIMH — Goldsmith, Varese Sarabande, 47231; SISTERS — Bernard Herrmann, Southern Cross, SCCD903; SOPHIE'S CHOICE — Marvin Hamlisch, Southern Cross, SCCD902; SOUND OF MUSIC, RCA, PCD 12005; STAR TREK Vol 2: TV series, Varese Saraband, 47235; STARMAN — Nitzsche, Varese Sarabande, 47220; STAYING ALIVE — Frank Stallone, Polygram, 813269-2; SUPERGIRL — Goldsmith, Varese Sarabande, 47218; TEACHERS, EMI, 746062; THIEF OF HEARTS, Polygram, 822942-2; WAVELENGTH — Tangerine Dream, Varese Sarabande, 47223; WITNESS — M. Jarre, Varese Sarabande, 47227; YEAR OF LIVING DANGEROUSLY, THE, Varese Sarabande, 47222.

SOUTHSIDE JOHNNY AND THE JUKES
IN THE HEAT, Polygram, 823747-2.

SPECIAL EFX
MODERN MANNERS, GRP, D9521; SPECIAL EFX, GRP, D9505.

SPIRO GYRA
MORNING DANCE, MCA, 37148-2.

SPLIT ENZ
CONFLICTING EMOTIONS, Festival, CD 53107; ENZ OF AN ERA, Festival, CD 52027.

SPRINGSTEEN, BRUCE
BORN IN THE USA, CBS, CDCBS86304; BORN TO RUN, CBS, CDCBS80959; DARKNESS ON THE EDGE OF TOWN, CBS, CDCBS86060; GREETINGS FROM ASHBURY PARK, CBS, CDCBS65480; THE RIVER, CBS, CDCBS88510; THE WILD, THE INNOCENT & THE E STREET SHUFFLE, CBS, CDCBS65780.

STAGE SHOWS
42nd STREET, RCA, RCD 13891; CAMELOT, Varese Sarabande, 47206; LA CAGE AUX FOLLES, RCA, RCD14824; CATS, Polygram, 817810-2; PORGY AND BESS (highlights), Polygram, 412720-2; STARLIGHT EXPRESS, Polygram, 821597-2; WEST SIDE STORY (complete), Polygram, 415253-2.

STATLER BROTHERS
ATLANTA BLUE, Polygram, 818652-2; BEST OF Vol. 1, Polygram, 822524-2; BEST OF Vol. 2, Polygram, 822525-2.

STATUS QUO
1+9+8+2, Polygram, 800035-2; BACK TO BACK, Polygram, 814662-2; BEST OF STATUS QUO, Polygram, CDNSP7773; NEVER TOO LATE, Polygram, 800053-2; TWELVE GOLD BARS, Polygram, 800062-2; TWELVE GOLD BARS Vol. 2, Polygram, 822985-2.

STEARNS, MICHAEL
M'OCEAN, Sonic Atmospheres, CD309.

STEELY DAN
AJA, MCA, 37214-2; GAUCHO, MCA, 37220-2; THE BEST OF STEELY DAN, MCA, 5570-2.

STEPS AHEAD
STEPS AHEAD, Elektra/Asylum, 60168-2.

STEWART, ROD
ATLANTIC CROSSING, Warner, 02875-2; BODY WISHES, Warner, 23877-2; CAMOUFLAGE, Warner, 25095-2; EVERY PICTURE TELLS A STORY, Polygram, 822385-2; ROD STEWART'S GREATEST HITS, Warner, 03373-2.

STILLS, STEPHEN
RIGHT BY YOU, Atlantic, 80177-2.

STING
DREAM OF THE BLUE TURTLES, Festival, CD 53134.

STITT, SONNY
MOONLIGHT IN VERMONT, Denon, C38-7046.

STRANGLERS
AURAL SCULPTURE, CBS, CDCBS26220; COLLECT, EMI, 746066.

STREISAND, BARBRA
EMOTION, CBS, CDCBS86309; GREATEST HITS Vol. II, CBS, CDCBS86079; GUILTY, CBS, CDCBS86122; THE WAY WE WERE, CBS, CDCBS69057; WET, CBS, CDCBS86104; XMAS ALBUM, CBS, CDCBS63158.

STYLE COUNCIL
CAFE BLEU, Polygram, 817535-2; OUR FAVOURITE SHOP, Polygram, 825700-2.

STYX
KILROY WAS HERE, Festival, CD 37926.

SUMMER, DONNA
CATS WITHOUT CLAWS, Warner, 250806-2; FLASHDANCE — original soundtrack, Polygram, 811492-2; SHE WORKS HARD FOR THE MONEY, Polygram, 812265-2; WALK AWAY, Polygram, 810011-2.

SUPERTRAMP
BROTHER, WHERE YOU BOUND, Festival, CD 53115.

SURMAN, JOHN
UPON REFLECTION, ECM, 825 472-2; WITHHOLDING PATTERN, ECM, 825 407-2.

SURVIVOR
EYE OF THE TIGER, Bellaphon, 290.14.021; VITAL SIGNS, Bellaphon, 290.14.030.

SWANSWAY
FUGITIVE KIND, Polygram, 818858-2.

SWEET PEOPLE
SWISS CONCERTO, Polygram, 3112-32.

SYLVIA
JUST SYLVIA, RCA, PCD14312.

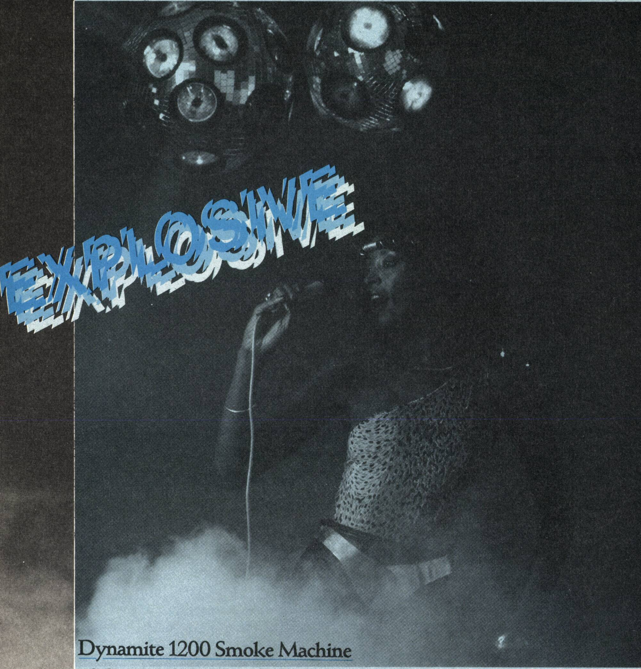
SYLVIAN, DAVID
BRILLIANT TREES, EMI, CDV 2290.

TAKANAKA
CAN I SING, Polygram, 3133-8; RAINBOW GOBLING, Polygram, 3133-10; SAUDADE, Polygram, 3133-1; TAKANAKA'S COCKTAIL, Polygram, 3133-24.

TALK TALK
IT'S MY LIFE, EMI, 746063.

TALKING HEADS
FEAR OF MUSIC, Warner, 6076-2; LITTLE CREATURES, EMI, 746158; REMAIN IN LIGHT, Warner, 6095-2; SPEAKING IN TONGUES, Warner, 23883-2; STOP MAKING SENSE, EMI, 746064.

TANGERINE DREAM
EXIT, EMI, CDV 2212; EXTRACTS FROM POLAND, Jive Electro, 8.26099 PHAEDRA, EMI, CDV 2010; RICOCHET, EMI, CDV 2044; RUBYCONN, EMI, CDV 2025;



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SWEET BABY JAMES, Warner, 18432

TEARS FOR FEARS
HURTING, Polygram, 811039-2; SONGS FROM THE BIG CHAIR, Polygram, 824300-2.

10CC
10 OUT OF 10, Polygram, 800039-2; 10CC'S GREATEST HITS, Polygram, 800056-2.

TERRY, CLARK
TRIO AND ONE, Polygram, 818840-2.

THIELMANS, TOOTS
SILVER COLLECTION, Polygram, 825086-2.

THIN LIZZY
LIZZY KILLERS, Polygram, 800060-2.

THIRD WORLD
ALL THE WAY STRONG, CBS, CDCBS25473.

THOMPSON, BARBARA
PURE FANTASY, Bellaphon, CDP5/8.

TIME
ICE CREAM CASTLE, Warner, 25109-2.

TJADER, CAL
LA ONDA VA DIEN, Festival, CD 39513; SONA LIBRE, Polygram, 815058-2.

TOGASHI, MASAHIKO
BREATH, Denon, C38-7281.

TOKYO BRASS ENSEMBLE
DIGITAL MARCH, Denon, C38-7027.

TOM PETTY AND THE HEARTBREAKERS
DAMN THE TORPEDOES, MCA, 5105-2.

TORME, MEL
DUKE ELLINGTON & COUNT BASIE SONGBOOK, Polygram, 823248-2. SWINGS SCHUBERT ALLEY, Polygram, 821581-2.

TORN, DAVID
BEST LAID PLANS, ECM, 823 642-2.

TOTO
ISOLATION, CBS, CDCBS86305; IV, CBS, CDCBS85529.

TOWER OF POWER
DIRECT, Sheffield Lab, CD-17.

TOWNER, RALPH
SOLO CONCERT, ECM, 827 268-2; SOLSTICE, ECM, 825 458-2; WORKS SERIES, ECM, 823 268-2.

TOWNSHEND, PETE
EMPTY GLASS, Atlantic, 321002.

TRIUMPH
ALLIED FORCES, MCA, 5542-2; THUNDER SEVEN, MCA, 5537-2.

PRIVATE DANCER, Festival, CD 53151.

TURRENTINE, STANLEY
STANLEY TURRENTINE, EMI, 746100.

TYLER, BONNIE
FASTER THAN THE SPEED OF NIGHT, CBS, CDCBS25304.

U2
THE UNFORGETTABLE FIRE, Festival, CD 53132.

UB40
GEOFFREY MORGAN, EMI, DEPCD 6; LABOUR OF LOVE, EMI, DEPCD 5.

URIAH HEEP
EQUATOR, CBS, CDPRT26414.

VALENTE, CATERINA
AROUND THE WORLD, Teldec, 8.26.149.ZP.

VALENTIN, DAVE
JUNGLE GARDEN, GRP, D9523; KALAHARI, GRP, D9508; LEGENDS, GRP, D9519; THE HAWK, GRP, D9515.

VAN DYKE PARKS
JUMP, Warner, 23829-2.

VAN HALEN
1984, Warner, 23985-2; DIVER DOWN, Warner, 3677-2; VAN HALEN, Warner, 3075-2.

VANGELIS
BEST OF JON & VANGELIS, Polygram, 821929-2; CHARIOTS OF FIRE — Soundtrack, Polygram, 800020-2; CHINA, Polygram, 813653-2; FRIENDS OF MR. CAIRO, Polygram, 800021-2; INVISIBLE CONNECTIONS, Polygram, 415196-2; MASK, Polygram, 825245-2; PRIVATE COLLECTION, Polygram, 813174-2; SHORT STORIES, Polygram, 800027-2; SOIL FESTIVITIES, Polygram, 823396-2.

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ANCHORS A WEIGH Vol 2, Polygram, 3111-5002; AROUND THE WORLD, Polygram, 820201-1; BANDS AND DANCE STRICTLY FOR DANCING, Polygram, 816141-2; BEATLES IN CLASSIC, Teldec, 8.25.579.ZP; BEST OF BLUE NOTE, EMI, 746099; BEST OF BRITISH TRADE JAZZ, Polygram, 818651-2; BEST OF ROCK CLASSICS, Teldec, 8.25.681.ZP; BEST OF ROCK AND ROLL: 8 groups, Bellaphon, 288.07.008; BOLERO, Polygram, 411928-2; BRASIL, Polygram, 822842-2; COMPACT DISCO, Polygram, 824642-2; COMPACT ROCK, Polygram. 823552-2; CONCERT FESTIVAL, Polygram, 415339-2; 24 COUNTRY AND WESTERN SONGS, Bellaphon, 290.13.006; DREAMLAND OF MELODY, Polygram, 822764-2; ECHOES OF ITALY, Polygram, 820038-2; ELECTRIC BOOGALOO BREAKDANCE 2, Polygram, 823696-2; EVERGREEN'S A'GO GO, Bellaphon, 290.07.001; EVERY MAN HAS A WOMAN, Polygram, 823940-2; Polygram, 411933-2; FLAMENCO GUITAR Vol 1, Bellaphon, CDLR44.003; FLAMENCO GUITAR Vol 2, Bellaphon, CDLR44.007; FOOTLOOSE, CBS, CDCBS70246; GALA CONCERT CD FESTIVAL, Polygram, 823492-2; GERMAN ARMY MARCHES, Polygram, 818630-2; GOLDEN AGE OF CHICAGO BLUES, Vogue, 6000 48; GREAT FILM THEMES, Polygram, 820040-2; GREAT MELODIES FROM OPERA, Polygram, 820042-2; HEAVY WAY, Polygram, 822750-2; HITS OF THE 60s — EASY LISTENING STYLE, Polygram, 820045-2; HITS ON CD, Polygram, 822843-2; HITS ON CD, Polygram, 818273-2; HITS ON CD Vol 3, Polygram, 824704-2; HOOKED ON CLASSICS, Teldec, 8.24.950.ZP; KINGS OF ROCK AND ROLL, Bellaphon, 290.13.007; IMMORTAL CLASSICS, Polygram, 411953-2; INSTRUMENTAL WORLD HITS, Delta, 11.005; LIEBESTRAUM, Polygram, 411934-2; LET'S GO TO THE MOVIES, Denon, C32-7099; MEXICO LINDO, Polygram, 824640-2; MOORE'S IRISH MELODIES, MCA, 79059-2; MUSIC OF JEROME KERN, Polygram, 820235-2; MUSICA POPULAR BRASILEIA, Polygram, 811336-2; NASHVILLE COUNTRY CLUB Vol 1, Bellaphon, 288.07.006; ODE TO JOY, Polygram, 411957-2; O SOLE MIO — Italian mandolins; Delta, 11.003; PANPIPE AND ORGAN, Delta, 11.004; POP HITS Vol 1, Bellaphon, 290.05.002; POP HITS, Vol 2, Bellaphon, 290.05.003; POP MUSIC, Bellaphon, 290.05.007; ROCK CLASSICS Vol 1 — London Symphony Orch, Teldec, 8.25.343.ZP; ROCK CLASSICS Vol 2, Teldec, 8.25.344.ZP; ROCK CLASSICS Vol 3, Teldec, 8.25.345.ZP; ROMANTIC CLARINET FOR LOVERS, Polygram, 818272-2; ROMANTIC FLUTE FOR LOVERS, Polygram, 816139-2; ROMANTIC GUITAR FOR LOVERS, Polygram, 814458-2; ROMANTIC PIANO FOR LOVERS, Polygram 814281-2; ROMANTIC POP SONGS FOR LOVERS, Polygram, 822315-2; SCREEN MUSIC OF LOVE AND PRIME, Polygram, 3133-8; SHANTIES, Polygram, 824189-2; SOFT AND EASY, Polygram, 3122-1; SONGS TO FALL IN LOVE, Bellaphon, 288.07.007; SOUNDS OF THE UNIVERSE— Super Hits from Science Fiction, Delta, 11.007; STARS AND STRIPES FOREVER Vol 1, Polygram, 311150001; SUPER FOLK MUSIC HIT PARADE, Teldec, 8.25.943.ZP; SWINGTIME, Polygram, 820044-2; TANGOS OF THE WORLD CD FESTIVAL, Polygram, 823477-2; VIENNESE BONBONS, Polygram, 820039-2; WAR OF THE WORLDS, CBS, CDCBS96000; WAY OUT WEST, Polygram, 820205-2; WE ARE THE WORLD, Polygram, P33M2900; WITH A SONG IN MY HEART, Polygram, 820194-2; GREAT MELODIES FROM THE CLASSICS, Polygram, 820043-2; ON BROADWAY — GREAT SHOW TUNES, Polygram, 820041-2; OPERA FESTIVAL, Polygram, 415341-2; ORIGINAL AMERICAN FOLK BLUES FESTIVAL, Polygram, 825502-2; TRIBUTE TO THELONIOUS MONK, Festival, CD 38324.

IRVING BERLIN SONGBOOK, Polygram, 822526-2; NO COUNT SARAH, Polygram, 824057-2; SARAH VAUGHAN, Polygram, 814641-2; SASSY SWINGS AGAIN, Polygram, 814587-2; THE DIVINE, Vogue, 6000 17.

VAUGHAN, STEVIE RAY
COULDN'T STAND THE WEATHER, CBS, CDEPC25940; TEXAS FLOOD, CDEPC25534.

VIENNA BOYS' CHOIR
FOLK SONGS, Polygram, 400014-2; MERRY CHRISTMAS, Polygram, 412551-2.

VISAGE
BEAT BOY, Polygram, 823052-2; FADE TO GREY, Polygram, 800022-2.

VIVALDI ENSEMBLE TOKYO
JAPANESE FAVOURITE MELODIES, Denon, C38-7018; JAPANESE FAVOURITE MELODIES ON BAROQUE, Denon, C38-7065.

VOLLENWEIDER ANDREAS
CAVERNA MAGICA, CBS, CDCBS25265; WHITE WINDS, CBS, CDCBS26195; BEHIND THE GARDENS, CBS, CDCBS85545.

WALCOTT/ABERCROMBIE/HOLLAND/ DEJOHNETTE
CLOUD DANCE, ECM, 825 469-2.

WALCOTT/CHERRY/VASCONCELOS
CODONA 3, ECM, 827 420-2.

WALSH, JOE
THE CONFESSOR, Warner, 25281-2; YOU BOUGHT IT, YOU NAME IT, Warner, 23884-2.

WARWICK, DIONNE
HOW MANY TIMES CAN WE SAY GOODBYE?, Festival, CD 53112.

WASHINGTON, DINAH
DINAH WASHINGTON & CLIFFORD BROWN, Polygram, 814639-2; FATS WALLER SONGBOOK, Polygram, 818930-2; WHAT A DIFFEREENCE A DAY MAKES, Polygram, 818815- 2.

WASHINGTON, GROVER JNR
COME MORNING, Elektra/Asylum, 5622; INSIDE MOVES, Elektra/Asylum, 60318-2; PARADISE, Elektra/Asylum, 182-2; THE BEST IS YET TO COME, Elektra/Asylum, 60215-2; WINELIGHT, Elektra/Asylum, 64305-2.

WATANABE, KAMUZI
KYLYN, Denon, C38-7135; LONESOME CAT, Denon, C38-7017; TO CHI KA, Denon, C38-7136; RENDEZVOUS, Warner, 250804-2.

WATERS, MUDDY
1948/1951, Vogue, 6000 52; ON CHESS 1951-59 Vol 2, Vogue, 6000 59.

WEATHER REPORT
DOMINO THEORY, CBS, CDCBS25839; HEAVY WEATHER, CBS, CDCBS81775; MYSTERIOUS TRAVELLER, CBS, CDCBS80027; NIGHT PASSAGE, CBS, CDCBS84597.

WEBBER, JULIAN LLOYD
TRAVELS WITH MY CELLO, Polygram, 412231-2.

WEBER, EBERHARD
WORKS SERIES, ECM, 825 429-2; CHORUS, ECM, 823 844-2.

WEBER, BEN
BIG BEN TIME, Polygram, 814410-2.

WESTMINSTER ABBEY CHOIR
CHRISTMAS CAROLS, Polygram, 413590-2.

WHAM
FANTASTIC, CBS, CDEPC25328; MAKE IT BIG, CBS, CDEPC86311.

WHEELER, KENNY
GNU HIGH, ECM, 825 591-2.

WHITTAKER, ROGER
BEST OF, Polygram, 814241-2.

WHO
IT'S HARD, Polygram, 800106-2; LIVE AT LEEDS, Polygram, 825339-2; SINGLES, Polygram, 815965-2; TOMMY, Polygram, 800077-2; WHO'S NEXT, Polygram, 813651-2.

WILDE, KIM
TEASES AND DARES, MCA, 12046-2.

WILLIAMS, JOHN
ECHOES OF SPAIN, CBS, CD36679.

WILLIAMS, ANDY
GREATEST LOVE CLASSICS, EMI, 240207.

WILLIAMS, HANK JNR
GREATEST HITS, Atlantic, 601932,

WILLIAMS, JOE
HAVING THE BLUES UNDER EUROPEAN SKIES, Denon, 7684; NOTHIN' BUT THE BLUES, Delos, 4001.

WILLIE AND THE POOR BOYS
WILLIE AND THE POOR BOYS, Polygram, 824606-2.

WILSON, ANDREW
THOMAS, Carnarvon, EMI 383146.

WILSON, NANCY
GODSEND, Denon, C38-7188; I'LL BE A SONG, Denon, C38-7061; KEEP YOU SATISFIED, Denon, 7597.

WILSON, TEDDY
GREATEST JAZZ PIANO, Polygram, 3112-21.

WINKLER, HARALD
ROMANTIC GUITAR DREAMS, Teldec, 8.26.141.ZP.

WINSTON, GEORGE
AUTUMN, Festival, CD 39869.

WOLF, PETER
LIGHTS OUT, EMI, 746046.

WONDER, STEVIE
WOMAN IN RED, RCA, ZD72285.

WORKING WEEK
WORKING NIGHTS, EMI, CDV 2343.

WORLD SAXOPHONE QUARTET
REVUE, Black Saint, BSR 0056CD; STEPPIN' WITH THE WSQ, Black Saint, BSR 0027CD.

WUNDERLICH, KLAUS
ROMANTISCHE MELODIEN, Polygram, 823485-2; 21 SOUTH AMERICAN FAVOURITES, Teldec, 8.25.771.ZP; GOLDEN SOUND, Teldec, 8.26.142.ZP; IN THE MILLER MOOD, Teldec, 8.23.026.ZP.

XTC
ENGLISH SETTLEMENT, EMI, CDV 2223; THE BIG EXPRESS, EMI, CDV 2325.

Y & T
IN ROCK WE TRUST, Festival, CD 38279.

YAMASHTA, STOMU
SEA AND SKY, Victor, VDP-15.

YAMAUCHI, KIMIKO
KOTO NA TABE, Denon, C32-7185.

YARDBIRDS
FIRST RECORDINGS, Bellaphon, CDLR44.001.

YAZOO
UPSTAIRS AT ERIC'S, EMI, 846803; YOU AND ME BOTH, EMI, 846806.

YES
90125, Atlantic, 90125-2.

YOUNG, NEIL
HARVEST, Warner, 2277-2.

YOUNG, PAUL
NO PARLEZ, CBS, CDCBS25521; THE SECRET OF ASSOCIATION, CBS, CDCBS26234.

ZAMFIR, GHEORGHE
CHRISTMAS PORTRAIT, Polygram, 822571-2; MAGIC OF THE PAN FLUTE, Polygram, 821698-2; MUSIC BY CANDLELIGHT, Polygram, 810010-2; ROMANCE, Polygram, 810968-2; RHAPSODY/CONCERTO FOR PAN FLUTE, Polygram, 412221-2.

ZZ TOP
DEGUELLO, Warner, 33612; ELIMINATOR, Warner, 23774-2; THE BEST OF ZZ TOP, MCA, 3273-2.

This concludes the CD listing. Back issues of the complete listing are available from *Electronics Australia*, 140 Joynton Avenue, Waterloo 2017.

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Information centre

Ignition Killer won't kill

In September 1985, I purchased your magazine to build the Ignition Killer switch.

To date I have not been able to get it working even though I have had three new timers put in and tested on my car three times by one of the Dick Smith store staff and declared to be in perfect working order as a unit.

They say that there is no reason that it should not work. All parts have been tested again and again. Can you help me? (G.D., Joondanna, WA.)

• To bench test this unit, simply connect it to a power supply and check that the relay turns on and off at about four second intervals.

Once correct operation has been verified, it can be installed in the car with the output lead connected to the negative terminal of the coil. If the engine fails to stop when the Ignition Killer is activated, try reducing the 15Ω/5W resistor.

Deluxe Car Burglar Alarm

Recently I bought the Deluxe Car Burglar Alarm and fitted it to a 1973 Galant. Initially, the unit tested perfectly but subsequent use has shown that it tends to false trigger.

The only change I made was to bridge the switch terminals and install a switch between the battery and the alarm. Note: I do not have the backup battery. The inputs used are the doors, boot, bonnet, and ignition (which is connected to the coil). Can you suggest any parts to look at or try changing?

As I have been a reader of EA for many years I hope you can find the time to help me and any others that might be having the same problem.

Another problem discovered by a friend concerns the reed switch. He found that after a dozen or so entries the reed switch welded itself. This problem was alleviated by installing a 10kΩ resistor in one of the leads which means that you have to hold the magnet near to it for a longer period of time (about a second). (M.S., Whalen, NSW.)

• This is the first time we have heard of false triggering problems with the Deluxe Car Burglar Alarm. We suspect that you either have an intermittent sensor switch or a bad wiring connection to one of these switches.

To locate the fault, try isolating each sensor in turn. You should also carefully check the positive supply and earth connections. Finally, check that the 1μF input capacitors have been installed the right way round.

The installation of a 10kΩ resistor in series with the reed switch is quite valid and is probably a worthwhile modification to extend its contact life.

Parts for rally computer

I am writing regarding your article in *Electronics Australia* for June and July 1985, concerning the building of a rally computer.

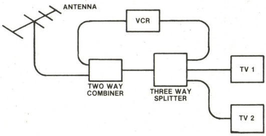
I have made enquiries here in New Zealand for the parts involved in building this computer, and find that not all parts are stocked. The parts are: FND508 LED readout; EPROM programmable chip; the two plastic boxes; two PC boards; and a 0.15μF metallised polyester capacitor.

If you could let me know where these parts can be obtained, I would be very grateful. (C.C., Auckland, NZ.)

• The FND508 is now in short supply but you can substitute the FND568 which is a higher brightness version. This is available from George Brown & Co Pty Ltd, 174 Parramatta Rd, Camperdown, NSW 2050. Note that the matching FND567 7-segment LED display is equivalent to the FND507.

Alternatively, Radio Spares (Unit C, 6 Durdans Ave, Rosebery, NSW 2018) stock pin equivalent displays under cata-

Connecting a VCR to two TV sets



I am hoping that you will advise me concerning the efficiency or deficiencies of the attached circuit. It is a 75-ohm TV antenna hookup using splitter boxes.

A friend of mine has made one up and it appears to give him all the versatility he requires for his two TVs and one video recorder. His locality is line of sight to the TV transmitter, distance approximately 7km.

I have a similar system of two TV's and one video recorder which I would like to use in the same fashion — ie, both TVs operating off air, or video to one TV while the other TV is tuned to a local channel.

My residence is situated approximately 18km from the TV transmitter, but does have a clear line of sight. (N.B., Auckland, NZ.)

• The accompanying diagram shows how to connect your TVs and VCR to do the job you want. You will need a two-way combiner (actually, a splitter wired backwards) and a three-way splitter (use a four-way splitter and fit a 75Ω resistor to the spare position).

Note that output from the splitter goes to the VCR input, while the VCR output is fed into the combiner. Be sure to use a decent antenna, otherwise signal losses will result in a "snowy" picture.

Inverters for solar power

This letter is in response to K.P. (EA, January 1986) who has gone solar rather than pay big money to have mains power brought to his property. You are right K.P. — there are more like you, and there will be more.

Like you, we were quoted a large figure to bring power to our block and, as we are starting from scratch, we knew we had to make the decision now, so we chose to go solar. We have started in a small way, but know it is practical and possible, because we are doing it.

Again, like K.P. we planned on setting up with the high efficiency Philips SQ lamps, but found that the 300VA inverter will not start them, even with an ordinary 40W lamp load as well to improve the pulse width. I think K.P. may have to consider a 1000VA inverter for his lighting, not for its capacity, but for its lower impedance. Even so, I would try it before buying.

Incidentally, my 300VA inverter will not run my shaver unless a 40W lamp is plugged in as well, and it will not start a 20W fluorescent tube. However, it does a fine job with video gear, our computer and similar appliances. The Epyx Fast Load Cartridge does not like either the square wave or the spikes though. I am about to incorporate the de-spiking circuits from the November issue, which may improve things.

I would be pleased to swap ideas, etc, with other people in the same situation, so would you please publish our address. (A.C. Wallace, PO Box 724, Berri 5343, SA.)

logue number 587-067 for the ±1 digit type and 587-945 for the 7-segment type. These do not have an integral red filter, however.

The remaining parts can all be obtained from Jaycar Pty Ltd, 115-117 Parramatta Rd, Concord, NSW 2137. We'll program the EPROM for you for a $5 fee plus a self-addressed envelope.

Marklin on the Railmaster

In Information Centre for January 1986, A.H. Morley of WA suggested a simple solution to modify a Marklin loco for use with the Railmaster train controller. Obviously A.H. is not a dedicated Marklin train hobbyist, otherwise he would not have suggested this simple solution or asked why Marklin use the AC system.

Consider a basic track layout called a reverse loop or, more simply, a figure of eight. Feed AC or the Railmaster output to this layout and run a Marklin loco. You will find that your loco transverses round and round the figure of eight to your heart's content.

Now consider the same layout using the Railmaster and a DC loco (which is polarity conscious). If you trace the polarities around the layout you will find that they change at various points, so in theory the loco would not know whether it was coming or going.

I think Marklin knew what they were doing when they opted for AC instead of DC and I have only suggested a simple layout as an example.

Reflect for a moment on the polarity nightmares of a big layout using four Railmasters or more. The price you pay using AC is a so-called cumbersome reversing solenoid (which is not jerky if A.H. cares to read my article in EA March, 1985). This is a small price to pay when you consider the enormous advantages of an AC non-polarised system versus a polarity-conscious DC system.

Hornby have produced a computerised control which feeds 18VAC to the track and Marklin are doing likewise. Perhaps *Electronics Australia* can produce some circuits which would satisfy both the AC and DC enthusiasts and at a price we all can afford. (R.B., Merrylands, NSW.)

- We have all the information necessary to design a command control system, similar to the Hornby Zero One. However, we are uncertain as to whether there would be sufficient interest to justify the time and effort involved in such a project. We invite readers to write in with their views. If we get a reasonable response, we will go ahead. (Editor's note: another letter on this subject is featured in "Letters to the Editor" on page 5.)

Speakers for electronic organs

I currently own a Schober Consolette II electronic organ which has always operated via a hifi amplifier and loudspeakers. Recently, I burnt out the high frequency drivers in the loudspeakers

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2 Meg dual $2
250K dual $1
1K dual $1
5K single 50c
250K single 50c
10K single 50c
2 Meg single 50c
25K dual ganged $1

Information Centre . . . ctd

and this was blamed on the organ.

I have now decided to install a separate amplifier and loudspeaker system for the organ and would appreciate your advice on the following:

(1) What is your recommendation for a suitable amplifier — preferably a kitset available from a recognised kitset supplier.

(2) I would like to add a reverberation unit to replace the existing "Reverbatape" which was a dismal failure. Has EA described a wholly electronic unit or is there something commercially suitable?

(3) Are there any particular criteria for organ speakers? What would you suggest as a reasonable unit for a domestic application on the assumption that I build my own cabinets.

The organ itself is relatively modest and so the demands in terms of power, frequency response, etc, would also be equally modest. Any advice you can give in these areas would be greatly appreciated. (B.W., Mt Gambier, SA.)

• The High-Power Mosfet Amplifier Module described in October 1985 (File 1/MA/62) should be quite suitable for use with your Schober organ. We have never described a suitable reverberation unit. There are a number of commercial units available, although some of these are not exactly cheap.

Organ loudspeakers should have high power handling capability coupled with a smooth bass response. Again, we have published nothing in this field in recent years and can only refer you to commercial systems.

Digital thermometer

I am looking for a digital thermometer circuit with a liquid crystal display, that is capable of measuring temperatures from 15°C to 400°C.

I am not keen on using a thermocouple but with such temperatures it is probably impossible to use a silicon sensor diode. If I must use a thermocouple, could you please advise me on where I could obtain one and how much it will cost. (M.H., Ormiston, Qld.)

• Unfortunately, the digital thermometer described in our February 1982 issue uses a semiconductor probe and will not operate at the high temperature you specify.

However, in October 1984 we published a temperature probe which could be used with any multimeter and which used a thermocouple. It can measure temperatures up to 350°C on a continuous basis, or up to 400°C intermittently. Copies of the article (File: 3/MS/110) can be obtained via our Information Service for $4.00.

Relay for the Ignition Killer

I took advantage of your free PC board offer for the Ignition Killer in the September 1985 issue of EA. I was able to obtain all parts but one in Western Australia. The part in question is the DPDT 12V relay with 10A contacts.

As I do not want to change the PC board would you advise me of a place in New South Wales where I could obtain the relay detailed in your article. (R.T., Greenmount, WA.)

• You should be able to obtain the relay you want from Altronics Pty Ltd, 151 York St, Subiaco 6000, WA. Failing that, try Jaycar Pty Ltd in Sydney.

Automatic timer circuits

I would like to obtain circuits for automatically turning off battery equipment with adjustable time delay up to two hours to save batteries. I also require similar circuits for controlling small mains appliances (eg, fans). Perhaps the same circuitry as for DC could be adapted using a transformer power supply and relay to control the mains switching.

Have you ever published any of these? It must be quite common for battery-powered equipment to be left on, thereby sending the batteries flat. I would appreciate any help in this matter.

Thank you for a well put together magazine. I have been purchasing EA since 1967. (E.L., Armadale, WA.)

• A commercial timer (eg, from Kambrook) is probably the best way to go about controlling mains appliances. We don't have anything suitable for controlling battery-powered appliances and will have a look at the subject in the near future.

NOTES & ERRATA

PLAYMASTER STEREO AM/FM TUNER (December 1985, 2/TU/55): The four Philips PL14/8 potcores used for the 9kHz notch filters (L6 and L7) and 19kHz notch filters (L18 and L19) will be supplied with a different ferrite material from the original part specified. The new type number is 4322 022 22050. Coil winding details for these four coils are now 303 turns each using 36B&S enamelled copper wire. Please alter these details in Table 1 of the February 1986 issue.

In the alignment article of March 1986, the adjustment of the 19kHz notch filters in step 4, page 80, should be made with the FM tuner set in mono.

The CSC500K7 50pF capacitor used with IC4, the MC13020P AM stereo decoder, will be replaced with a 30pF type in subsequent kits.

Some of the Philips miniature ceramic plate capacitor type numbers have been changed due to supply availability. The capacitance values, however, remain the same.

For kit suppliers here are the new type numbers.

1.5pF	2222 681 03158
3.3pF	2222 681 09338
4.7pF	2222 680 03478
6.8pF	2222 680 09688
27pF	2222 681 10279
47pF	2222 680 34479
82pF	2222 680 58829
100pF	2222 680 34101
680pF	2222 630 09681
0.001μF	2222 629 08102
0.01μF	2222 640 03103

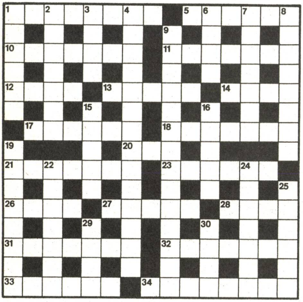
THREE-WAY COMBINATION LOCK (Circuit & Design Ideas, February 1986): A 68Ω resistor in series with the power switch was omitted from the circuit diagram. It should be included to prevent the battery being shorted for some positions of S1.

SIMPLE CAR ALARM CIRCUIT (Circuit & Design Ideas, February 1986): Some of the component numbers were omitted from the circuit diagram and Q1 is wrongly referred to as Q2 in the text, IC2a is associated with pins 1, 2 and 3 of the 4093; IC2b is pins 4, 5 and 6 and IC2e is pins 8, 9 and 10. IC2d is not used and pins 12 and 13 should be tied to the negative supply line.

-APRIL CROSSWORD-

ACROSS

1. Second part of your electronics engineering course? (5,3)
5. Computer co-ordinators. (6)
10. Electronic marine equipment. (7)
11. Said of charged particles. (7)
12. At a constant level. (4)
13. Kind of diagram. (5)
14. Additional transformer core. (4)
17. Secondary channel. (6)
18. The first TV camera tube used in regular broadcasts. (7)
20. Integrated radio apparatus. (3)
21. Basic rule of electronics. (4,3)
23. Activate a computer. (6)
26. Connecting strips. (4)
27. Similar charges do it. (5)
28. Result of overuse of keyboard. (4)
31. The word could precede a PU. (7)
32. Different atom but with same number of neutrons. (7)
33. Supports for microphones. (6)
34. A parallel resonant circuit. (8)



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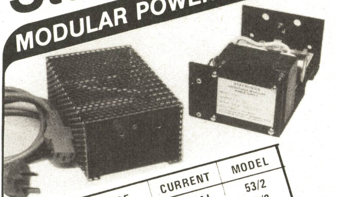

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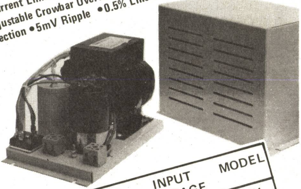

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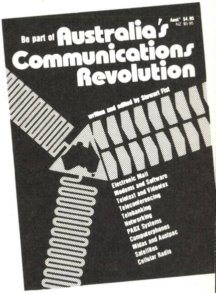

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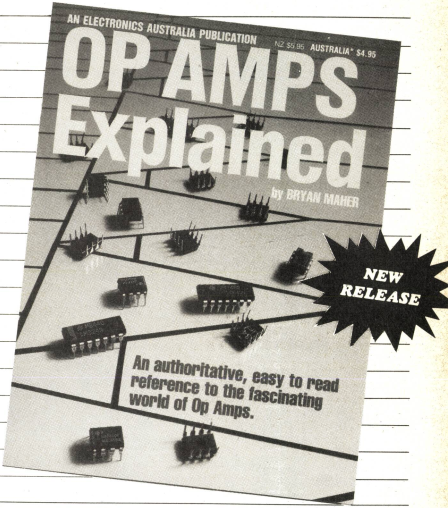
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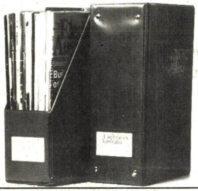

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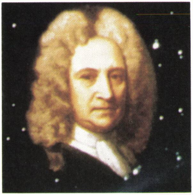

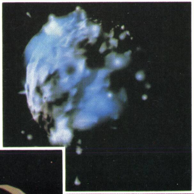

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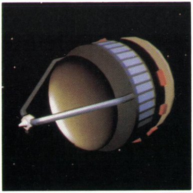

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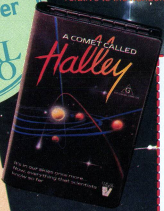
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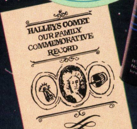

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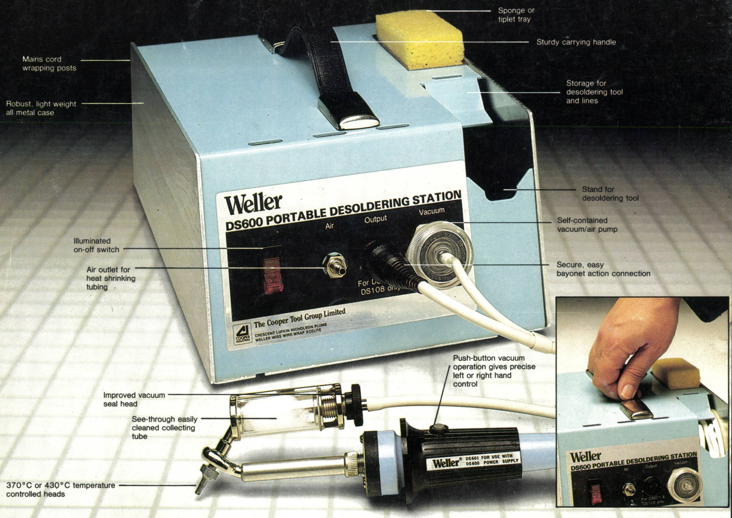
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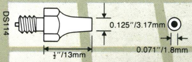

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